IRIS | DEPARTMENT OF LIFE SCIENCES | JAI HIND COLLEGE

THE CATALYST

ISSUE 2

Our Mentor

Dr. Ashok Wadia
Principal, Jai Hind College

Team Catalyst is eternally grateful for your constant support!

Issue 2

The Catalyst

Department of Life Sciences

We are presenting to you, a glimpse of our department through the 2nd issue of our student-led magazine.
Join us on this journey of exploration and learning!

2021 - 2022

Dept. of Life Sciences
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The department hereby welcomes the enthusiastic explorers!

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Special Thanks to:

Mr. Rupesh Gawde

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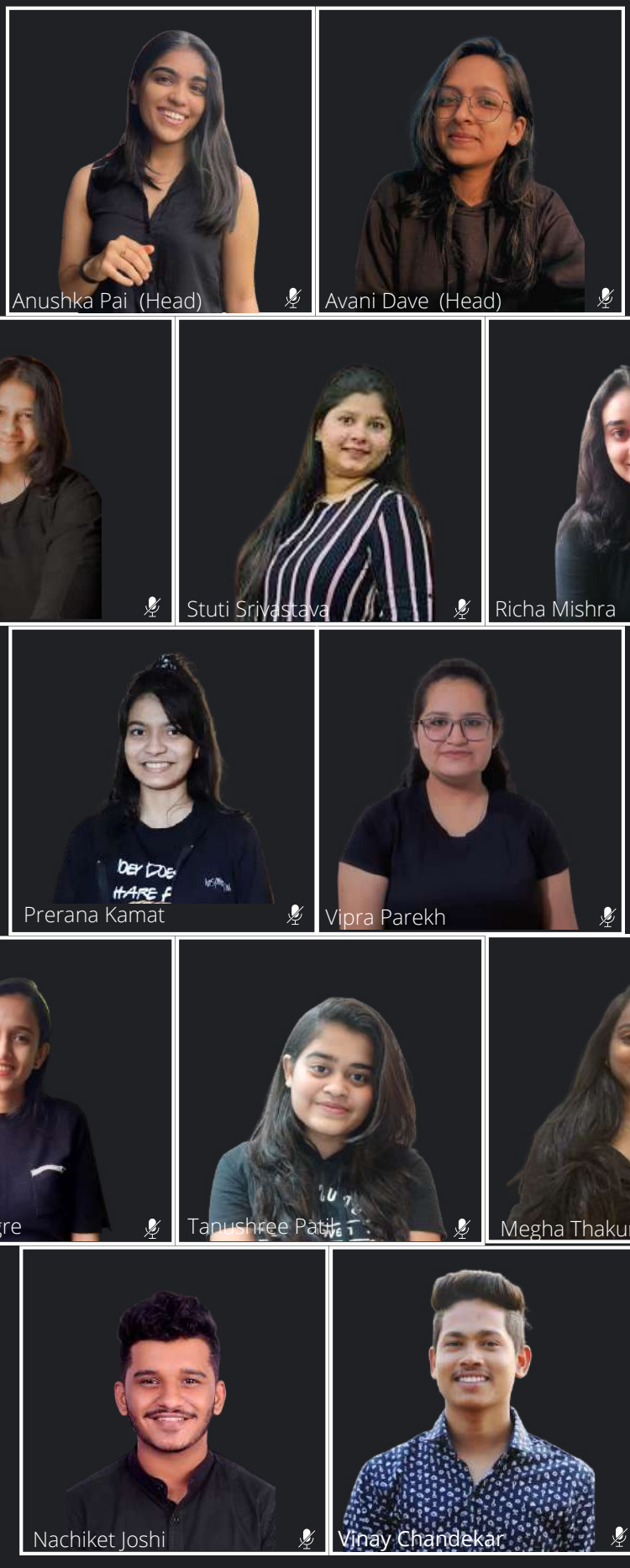
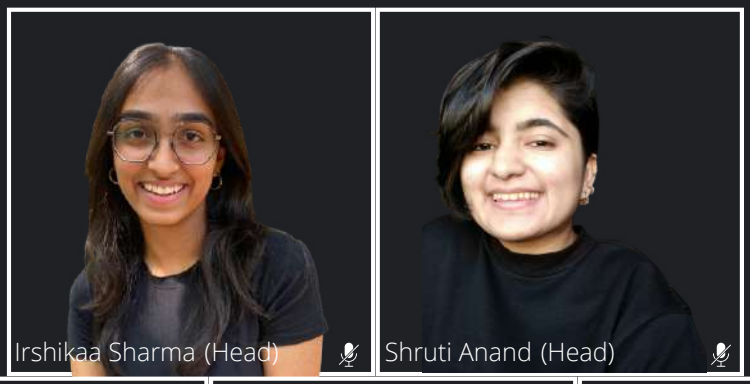
TEAM CREATIVES



TEAM EDITORIAL



Achievements

XPLORE, 2022 (TYBSc)

1) Anushka Pai (1st Prize)
Topic: Effects of Food Additives on Zebrafish Model

2) Jheel Popat (2nd Prize)
Topic: The Effects of Various OTC Drugs on *Daphnia*

3) Yogita Tiwari (3rd Prize)
Topic: Phyto Power

E-SHODH

1) Roshni Keshwani (Consolation prize)
Topic: SARS-CoV-2 v/s MERS-CoV: A Proteomic and Genomic Comparison using Bioinformatics Tools for Prospective Treatment.

2) Sanika Naik and Tanushree Patil (Participated)
Topic: Advancement in Material Science Perspective to Combat COVID - 19 using Nanotechnology.

3) Odelia Rebello and Anushka Pai (Participated)
Topic: Scientific Timeline of COVID-19 in India

SCHOLARSHIPS

Priyadarshini Scholarship, 2022
1) Shruti Anand - TYBSc

Sumitomo Scholarship, 2022
1) Manali Chakraborty - SYBSc
2) Avani Dave - TYBSc

PUBLICATIONS

1) Shruti Anand
Topic: Inheritance of Human Social Behaviour
Journal: International Journal of Life Sciences (Vol. 10 No. 1, 2022)

2) Roshni Keshwani
Topic :
- Alzheimer's, Parkinson's, and Huntington's Disease: A Homology Modelling Study
- Clinical Manifestation and Prognosis of Graves' Disease Show

Journal: Compendium of "Research insights of life science students". (Vol. – 3/2021)

INTERCOLLEGIATE COMPETITIONS

1) Odelia Rebello - 2nd Prize
Alchemia - Xavier's (Presentation and Storytelling)

2) Riya Mehta & Kainat Khan - 1st Prize
Swami Vivekananda Research and PPT Competition - Thakur College

3) Sanika Naik and Tanushree Patil
- Chemtastic - Thakur College. PPT - 1st Prize
- Chemfest Atom - C.H.M College - Presentation on Green Chemistry - 2nd Prize

4) Sanika Naik
- Chemoscope - Sophia College. Chemo-doodle-do - 3rd Prize
- Chemtastic - Thakur College. Picasso Alert - 1st Prize

5) Tanushree Patil
- Chemoscope - Sophia College. Chemo-doodle-do - 1st Prize
- Chemtastic - Thakur College. Clueminati - 3rd prize

Achievements

AAVISHKAR

1) Yogita Tiwari (TYBSc)
Topic: Phyto Power - A Novel Renewable Energy Source.
Category: Pure Sciences
Guided by: Dr. K. Srilatha

2) Avani Dave (TYBSc)
Topic: Comparative study of Natural v/s Artificial Solvents for Disintegration and Recycling of Expanded Polystyrene.
Category: Pure Sciences
Guided by: Niloufer Kotwal

3) Zarhaan Khambatta (TYBSc)
Topic: To Study the Allelopathic Effect of Garlic on Plants such as Tomato, Cucumber, and Eggplant.
Category: Pure Sciences
Guided by: Dr. K. Srilatha

4) Shruti Anand (TYBSc)
Topic: Comparative Study of Quality of Hair and Genotoxic Effects of Natural v/s Chemical Hair Dye.
Category: Pure Sciences
Guided by: Niloufer Kotwal

5) Roshni Keshwani (TYBSc)
Topic :SARS-CoV-2 v/s MERS-CoV: A Proteomic and Genomic Comparison using Bioinformatics Tools for Prospective Treatment.
Category : Medicine and Pharmacy
Guided by: Niloufer Kotwal

6) Richa Mishra (TYBSc)
Topic : Environmental Application of Immobilized Yeast Cells and Free Yeast Cells as Biofertilizer.
Category: Pure Sciences
Guided by: Niloufer Kotwal

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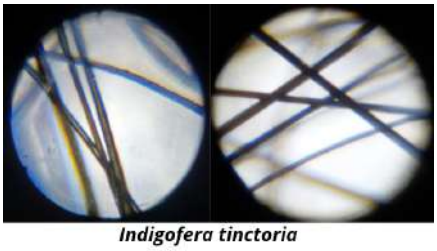
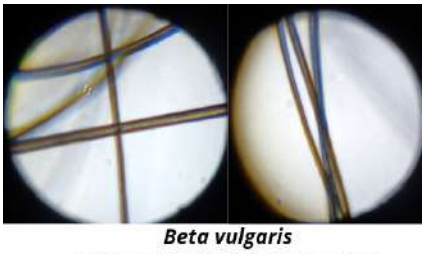
Environmental
Biotechnology

NATURAL VS CHEMICAL DYES: HAIR QUALITY & COLOR RETENTION

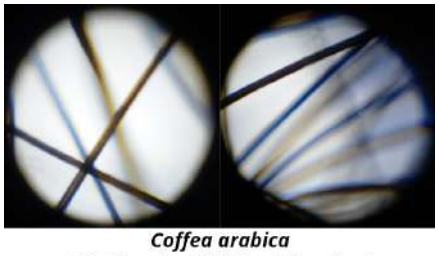
Since the beginning of mankind, hair has always played a symbolic role in a person's life. It portrays who we are and how we wish to perceive ourselves. Not only do women but people of all genders and ages use hair as a way to express themselves, due to which it has become a large global market that comprises hair styling and hair dying products. But a drawback of these chemical dye products is that for reliable results, oxidative treatment is necessary which causes hair damage and depletes hair quality thereby making it stiff and brittle.



Indigofera tinctoria
(A) Bleached (B) Not Bleached

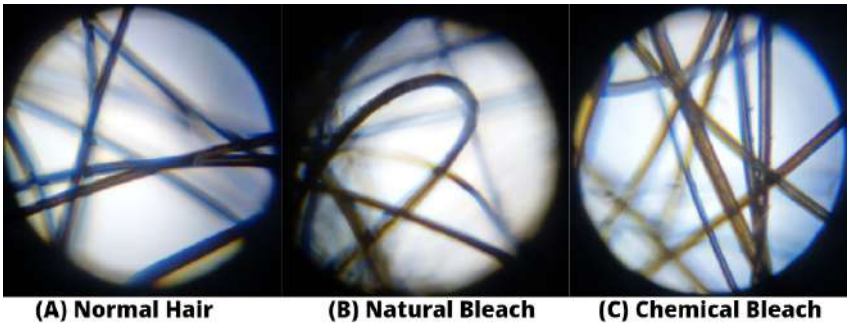


Beta vulgaris
(A) Bleached (B) Not Bleached



Coffea arabica
(A) Bleached (B) Not Bleached

In a recent study, there has been evidence showing that dye interacts with DNA causing probable mutations that could be carcinogenic. As we are evolving, there is a need to "go organic", due to it being a safer and healthier option for both the planet and us. This is where natural dyes could be extracted out of plant parts. Some plants that are known for their colorant properties are *Indigofera tinctoria, Beta vulgaris* and *Coffea arabica*. Apart from being good dyeing agents, plants like *Citrus limon* are used for their whitening property on the face but they could be used to lighten hair color, too.



(A) Normal Hair (B) Natural Bleach (C) Chemical Bleach

This study aimed to do a comparative analysis between a semi-permanent dye and natural dyes on normal and bleached hair to check for their effect. Apart from this, there was an attempt made to come up with a natural bleaching agent, in the form of *Citrus limon*.

The need for this study was to formulate and provide an alternative for the chemical dyes found in the market as they show probable mutations that may or may not be cancerous. It is also important to create awareness of the ingredients found in these dyes as they have harmful and lasting effects on our body. As a proper formulation for the natural dyes can be researched more on, we should also be checking for the genotoxic effects of these dyes so as to make sure that whoever comes in contact with it can be made aware.

Citrus limon is not a good bleaching agent whereas *Indigofera tinctoria* and *Coffea arabica* can be used as dyeing agents with further formulation to make them the best versions of themselves for the public. On comparison, it was noticed that both *Indigofera tinctoria* and *Coffea arabica* helped in retaining the hair porosity which was affected by bleaching of hair. They also lasted for 10-12 washes which was much higher than the chemical dyes. *Beta vulgaris* can help in enhancing the hair porosity due to the presence of carotenoids.

SHRUTI ANAND

RECYCLING EXPANDED POLYSTYRENE BY USING ORANGE OIL (D-LIMONENE)

Polystyrene is regarded as desirable in a variety of sectors, and a reduction in its use would be a loss-incurring step that few businesses would be willing to take. As a consequence, until the recycling front is acknowledged and encouraged, polystyrene trash will end up in landfills.
D-limonene (a major terpene found in orange oil) is stated to be devoid of carcinogenic, mutagenic, and nephrotic characteristics, based on its LD50 value and repeated dose toxicity tests.

The information obtained during the course of the study can be used to improve the recycling of polystyrene waste and take a collaborative step towards nurturing the planet, one residential complex at a time.

A three-step process was followed to recycle EPS:

1. Preparation of essential oil - To obtain orange peels from juice centers and restaurants and following the protocol of solvent extraction to make orange peel oil using Isopropyl alcohol
2. Identifying the effect of various combinations of Natural and Synthetic solvent on the composition of the resulting dissolved EPS, while keeping the amount of EPS a constant 0.350 + 0.002 gm.
3. Verification of D-limonene efficiency – Efficiency of the crude orange oil extract (impure) was accurately reflected by comparing it with 100% pure orange oil.

The diversion of expanded polystyrene (EPS) and orange peel waste from landfills is a merger of two very effective advantages and the goal is to determine the efficacy of extracting D-limonene oil using a simple solvent extraction method without the need for any complicated lab equipment or protocols. The idea is to see if each family can employ this method of producing their own D-limonene oil and directing it to EPS recycling to produce lightweight and sturdy goods. Since artificial solvents will be replaced by natural solvents for EPS recycling, the safety of users and the protection of the environment will be ensured. This will allow us to develop various sustainable businesses around the concept and increase employment opportunities; increase awareness and social contribution in building a sustainable community; establish this recycling protocol for local level waste management, with municipal or government assistance.

Accessories

Paper-weight

Different concentrations and combinations of solvents were needed to achieve a specific form of the dissolved product. D-limonene crude extract was seen to relatively reduce the activity of acetone on EPS by forming a layer of protective coating around the sample. Since the behavior of pure, crude orange oil was very distinct, both individually and when paired with acetone, we can conclude that oil prepared during the study was highly inefficient and hence, cannot be used unless purified. Disintegrated EPS was allowed to solidify and designed to make lightweight and sturdy regular utility products.

AVANI DAVE

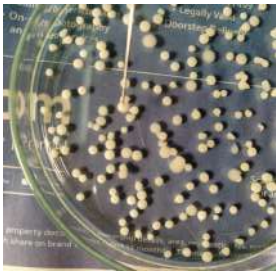
USING IMMOBILIZED YEAST AND FREE YEAST CELLS AS A BIOFERTILIZER

In the next thirty years, the world's population is expected to exceed ten billion people. By 2050, food and feed production will need to increase by 60% to meet the projected food demand. To avoid future supply problems, food production is being expanded. In the long run, a slow-release fertilizer may be more effective. Slow-release fertilizers come in the form of bead-like grains. Rather than overloading the soil with food all at once, they deliver little doses of nutrients over time. This makes them less likely to damage roots and foliage and offers them a longer lifespan than liquid fertilizers. They can deliver nutrients for a few weeks or up to 9 months, depending on their contents.

As a result, using immobilized microorganisms has a good impact on the environment and plant growth, solving the interconnected challenges of global warming and food security. The immobilized microorganism used in this research is yeast.

In this experiment, the brewer's yeast (*Saccharomyces cerevisiae*), was immobilized using an inert, insoluble substance like sodium alginate.
The main objective of the study was to check whether the addition of free or immobilized yeast to the soil had an effect on the nitrogen (N), phosphorus (P) and sulphur (S) content of the soil and the overall growth of the plant.

CaCl2 + H2O Yeast + H2O Sodium Alginate + H2O



Three wheat grass plants were planted on 7th January, 2022 in which, the first pot contained an inorganic fertilizer (DAP), the second and third pot contained free yeast and immobilized yeast respectively as the biofertilizer. Water was added once daily from 7th January, 2022 till 22nd January, 2022. On the 23rd of January, the soil was tested for its nutrient content using a NPK testing kit. The soil's nutrients such as nitrogen (N), phosphorus (P), potassium (K) and the pH level, after exposure to organic fertilizers like free baker's yeast, immobilized baker's yeast and inorganic fertilizer (DAP) were compared.

The findings suggest that yeast could be used as an effective biofertilizer in agriculture. The addition of yeast to the treated plant boosts its overall growth. It improved the NPK content significantly. They could also improve the soil's physical and chemical qualities, as well as its water holding capacity. It should be directed to farmers to prevent environmental pollution from broad application of artificial fertilizers as well as to ensure the community's physical condition and controllable agriculture.

RICHA MISHRA

LET'S FILTER WATER NATURALLY!

Water is second, only to oxygen, as a crucial life component, according to scientists. Water filtration is the elimination/lowering of particulate matter present in water. Several water filtering systems that exist, cannot be used by most individuals due to exorbitant costs or lack of technical expertise. The water purifying properties of a simple xylem filter and *Moringa oleifera* are investigated in this project. Pond water was filtered through both systems for this study.

The materials used for this experiment were Pine tree branch, *Moringa oleifera* seeds, PVC pipe, mortar, pestle, clamps and small bowls.
The filters were constructed as follows. Pine tree branches were cut and placed in water for the pine filter. Two inch sections were cut and fitted into PVC pipe, which was then clamped shut. Water was passed through the pipe to be filtered and then collected in a bowl. *Moringa* seed powder was blended with some clean water before being placed in unfiltered water. After fully mixing, it was allowed to rest before being filtered with clean water. Chemical tests were done to check for water purity. pH was checked using a pH meter. The water was checked for total dissolved solids and total suspended solids. The total hardness of filtered water was checked along with Calcium and Magnesium hardness. Tests for chloride and sulphate content were also done.

All the tests revealed that the water was thoroughly filtered by both systems and was potable. This study found that water filtration by *Moringa oleifera* seed powder was somewhat more effective than that by the simple xylem filter. Other research says that these water filtration systems have antibacterial properties and are excellent at screening microbes.

Tests	Observation for *Moringa oleifera* filter	Observation for xylem filter
Turbidity	50 NTU	50 NTU
pH	7.96	7.92
Total Alkalinity	25 mg/L	65 mg/L
Total dissolved solids	85 ppm	96 ppm
Total suspended solids	0.005 mg/L	0.007 mg/L
Conductivity	172 µs/cm	192 µs/cm
Total hardness	93.16 ppm	94.61 ppm
Calcium conc.	25ppm	29.94 ppm
Magnesium conc.	68.16 ppm	64.67 ppm
Chloride ion	80 ppm	100 ppm
Sulphate ion	< 10ppm	< 10 ppm

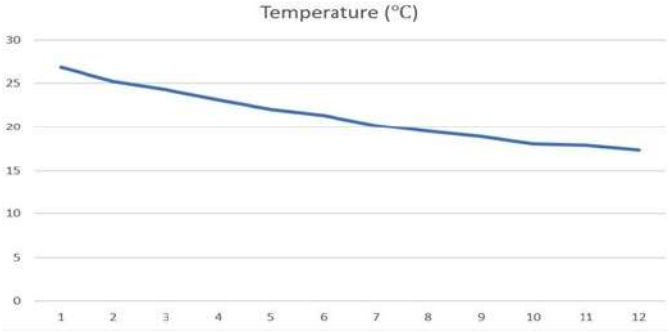
This simple, low-cost filtration system can help in remote regions, where access to water filtration technology is missing and health concerns related to contaminated water exist.

AVANI PATIL

A NATURAL WAY TO BECOME PAIN FREE!

Pain is a discomfort associated with a variety of injuries and illnesses that affect about 20% of adults worldwide. The discovery of new and more effective drugs that can relieve pain is an important research goal in both the pharmaceutical industry and academia. This review describes a study of the anti-inflammatory activity of essential oil formation using camphor, menthol, and thymol obtained from plant species by the distillation process.

Eutectic systems have been applied in pharmaceuticals to increase the drug solubility, permeation and absorption. They have been used as an oil phase in an emulsion system and the deep eutectic solvents (DESs) like small-molecule compounds were used as eutectic compounds such as OFCMT (Oily Formation of Camphor, Menthol, Thymol). The eutectic phenomenon relates to hydrogen bonding between compounds. The volatility of the formulation is due to the chemical properties and terpenoids that give essence and aroma. The formulation is immiscible in water but can act as a solvent in many biological studies.
Camphor is one of the most common treatments and is utilized by nearly every family in India for quite a few purposes. Menthol is significantly used in spraying creams and in dental practice. Thymol has been taken into consideration for its effective antiseptic, germicidal and anthelmintic properties. One of its vital uses in current years has been the remedy of hookworm disease. It is used in large part as a constituent of tooth-pastes and mouth-washes.



A eutectic system is a system of a homogeneous mixture of two or more substances that melts at a particular given temperature that is lower than the melting point of any of the constituent elements in that system.

This particular temperature is known as the eutectic point. Thus, for a liquid mixture eutectic point or the eutectic temperature is the lowest temperature at which a liquid can exist in a eutectic system. Thus, Camphor, Menthol and Thymol forms a eutectic system in the ratio (1:1:1).

Time (minutes)	Temperature (°C)
1	26.8
2	25.2
3	24.3
4	23.1
5	22.0
6	21.3
7	20.2
8	19.5
9	18.9
10	18.0
11	17.9
12	17.3

The decrease in temperature of about 9.5°C in 12 minutes shows that Camphor, Menthol and Thymol in 1:1:1 ratio acts as a eutectic system. OFCMT showed tremendous protection from swelling due to inflammation as observed in the study. The skin gets shriveled as water retention in the feet gets reduced due to daily application of the pain relief oil. This formulation works differently on every individual and the effects can be observed in between the first week and third week of proper application on the affected area. The study can be further extended for clinical trials and attempts can be made for the patency of the same.

DANIA PATNI

EFFECTS OF NATURAL SCRUB ON DIFFERENT SKIN TYPES

This research focuses on making natural body scrubs and determining which scrub suits which skin type the most. A scrub is a cream-based, coarse-textured skin care product used to slough off dead skin cells, dirt and sebum plugs from the skin. Scrubbing/Exfoliating has been an important step in the skincare routine because of the following benefits it renders:

- Removes Hardened Skin Impurities: Dead skin cells, dust and pollution give a dull appearance to the skin hiding your real complexion. A face scrub gently exfoliates such impurities, revealing your naturally bright skin tone.
- Prevents Acne: Acne is caused due to the sebum plug that clogs the skin pore, creating a breeding ground for bacteria which results in infection and acne conditions. A face scrub gently scoops out these plugs, leaving your skin healthy and free from chances of infection.
- Improves Your Skin Texture: Pollution and dead cells roughen your skin. By using a face scrub your skin regains its smooth texture giving it a glowing look.
- Increases Cell Turnover Rate: Skin naturally sloughs off dead skin cells as new cells are produced underneath. Exfoliating with a face scrub further increases your skin's cell turnover rate, thereby bringing healthy cells to the uppermost epithelium layer.

BEFORE

Aloe vera scrub: Preferable for dry, oily, sensitive skin; moisturizes the skin, can reduce itching and dry skin caused due to eczema without any side effects.

Coffee scrub: Preferable for oily skin as it removes dirt, oil and clogged sebum from pores. This scrub is not preferable for dry skin as it causes a burning sensation.

Orange scrub: Preferable for sensitive skin, as orange extracts deeply hydrate the skin and make it look younger by moisturizing and lightening the skin colour. It also shows anti-oxidative properties which makes the skin healthier.

Walnut Scrub: Not preferable for dry and sensitive skin types as it causes micro-tear and slight reddening on the skin.

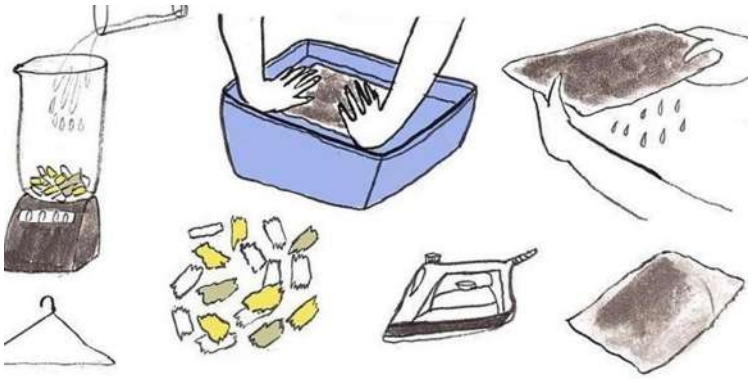
AFTER

To conclude, *Aloe vera* scrub can be used by all skin types and orange scrub for sensitive skin due to its anti-oxidative property, whereas, coffee and walnut scrub are not that advisable.

MAHEK SANGOI

MAKING PAPER OUT OF WASTE AND DYEING IT USING NATURAL COLOURS

Paper recycling is the circular method of turning previous paper into new paper, this use and manufacturing method is termed papermaking. Paper could be a 100% natural and reclaimable resource made from wood fibers. paper is recycled up to seven times, betting on the standard. Eventually, paper reaches a point where it can no longer be recycled due to the progressive shortening of fibers each time it is recycled.



To break down worn or old papers, the waste paper recycling process typically includes combining them with water. They're then broken up and boiled, which breaks it down even more into cellulose threads, a type of organic plant material. It was strained through screens/flour sieves and left in the sun for about 25 - 30 minutes to drain the excess water, then drained using a thick cotton cloth or any absorbent material.

The sieve was then tipped over onto a bed sheet or towel. Then it was cleaned and de-inked. Then it can be recycled into new paper. Recycled paper is more sustainable than paper made of virgin material only. Paper recycling saves space in landfills. It requires less energy than making virgin paper.

It conserves wood, reducing water pollution. Recycled paper also helps save trees because it lowers the demand for wood. This reduces deforestation and carbon footprint and reduces greenhouse gas emissions. Each metric ton (1,000 kilograms) of recycled paper can save approximately:

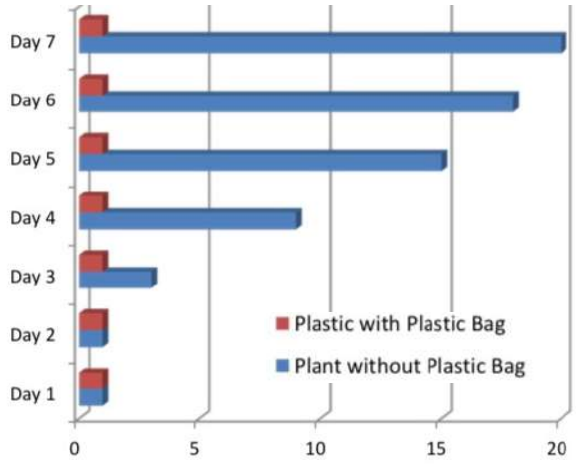
- 19 trees that can absorb 127 kilograms of carbon dioxide from the atmosphere each year
- 1,500 litres of oil
- 2.68 cubic meters of landfill space
- 4,400 kilowatts of energy
- 29,000 litres of water

The black ink on the printed paper could still be seen whereas the blue ink was dissolved completely. The color of all the natural dyes could be seen properly only the purple cabbage stain was not properly visible. That's why the blue color was also not visible. Natural Dyes are better for the environment and our health. Natural dyes are more expensive than artificial dyes and are non-toxic.

STUTI SRIVASTAVA

STUDY TO ASSESS AWARENESS LEVEL AND PERCEPTION ABOUT PLASTIC BAG HAZARDS

Plastic is a man made polymer and contemporary life would be impossible without it. Plastic items, such as plastic bags, play a vital part in our everyday activities due to a wide range of favorable properties such as lightness, flexibility, non-rusting and high durability.



The widespread use of plastic bags has harmed the environment, prompting a surge in research attempts to limit people's use of plastic bags. In recent years, several areas have experienced severe soil pollution as a result of plastic contamination.
The purpose of this study is to create awareness of the environmental hazards of using plastic bags. The goal of the experiment is to show how plastic bags affect plants (*Vigna radiata*), specifically their development and germination, as well as how plastic bags alter soil chemistry and decompose organic matter, in contrast to plants that are not exposed to plastic bags or their residue. This will aid in measuring the impacts of plastic bags on plant life and how they influence soil fertility, resulting in a growth arrest reaction from the plant.

Mung beans (*Vigna radiat*a) - 25 seeds, two transparent potted plants, potting soil (silt loam), newspaper and a transparent polythene bag are required. The experiment was carried out for 8 days and the data was analyzed and interpreted during this time. The two plants were kept in an area with adequate sunlight and watered daily.
Pot I - Cover with newspaper (Control).
Pot II - Mix a few small pieces of plastic bag into the soil and cover with a plastic bag.

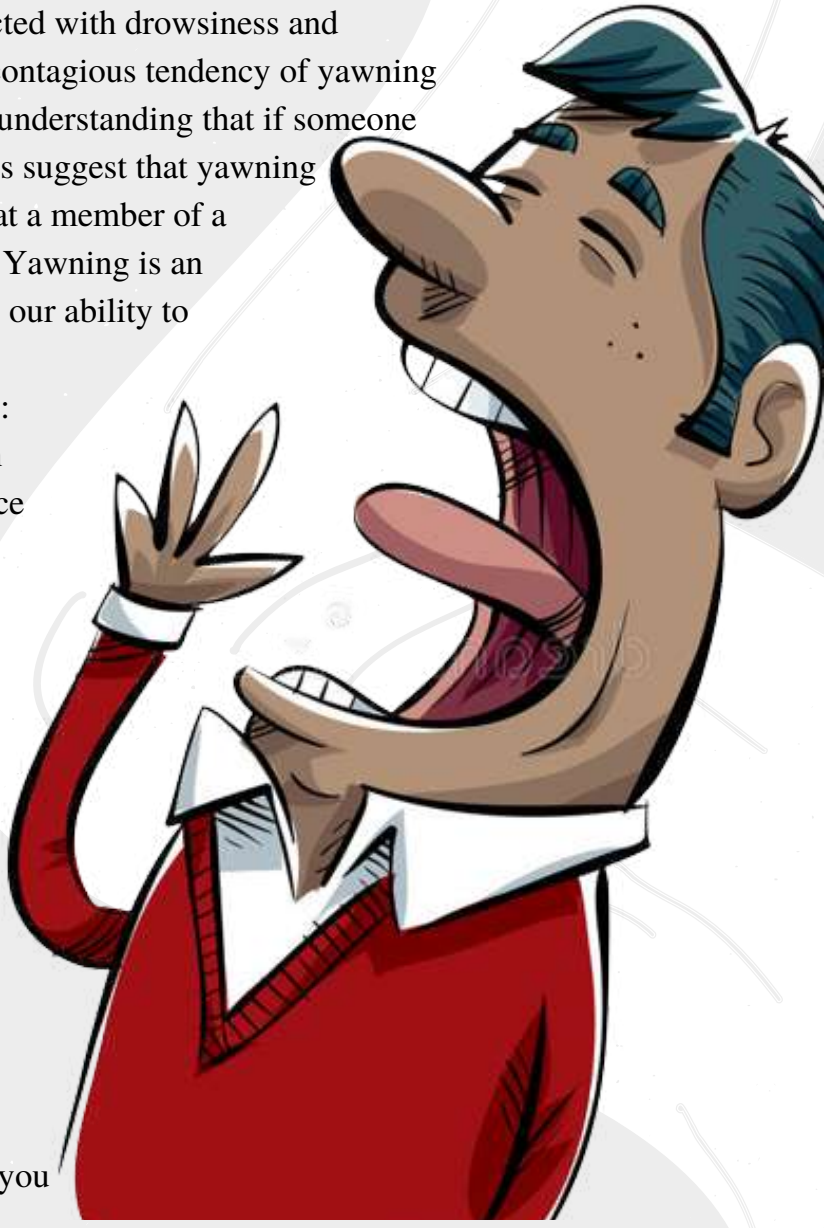
The presence of plastic bags had a substantial influence on the development of *Vigna radiata,* with the plant showing a growth arrest response when compared to the control. The extent to which plant development is affected by plastic is not well understood, but one possible explanation is that shredded plastic obstructs the free movement of root hair. Furthermore, shredded plastic containing appropriate level of air and water obstruct soil pore openings. As a result, *Vigna radiata* roots were unable to absorb enough water and nutrients to support their development. Plant respiration was also hampered due to a lack of aeration in the soil, as the presence of shredded mixed plastic disturbed soil's natural condition.

IQRA TELI

WHY DO WE YAWN ??

- Kainat Khan

Yawning is characterized by the opening of the mouth, which is followed by a prolonged inhalation, cessation of ventilation, and a quick expiration. Yawning has been connected with drowsiness and boredom since the beginning of time. The contagious tendency of yawning is said to arise from empathy, or an innate understanding that if someone else is yawning, you might as well. Theories suggest that yawning acts as a warning mechanism, indicating that a member of a group is potentially in danger or very tired. Yawning is an emotional and social trait that demonstrates our ability to connect with others, making it socially relevant. The possible reasons for yawning:



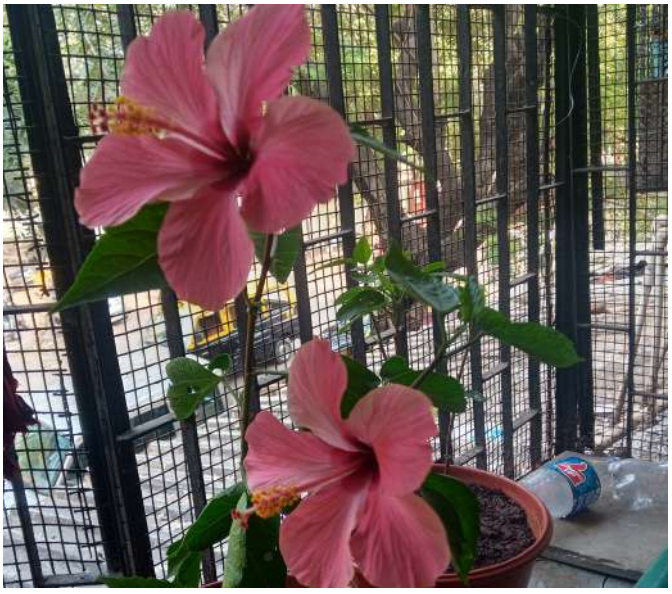
- Change in altitude- You could yawn on purpose, as an instinctive reflex or to balance the pressure in your ear.
- Empathy- Another significant contributor to yawning is social empathy. Seeing or reading about someone else yawning may drive you to yawn. If you're more empathetic, you're more likely to yawn when you watch someone else do it.
- Feeling bored or exhausted- Yawning isn't a symptom of being exhausted or bored, according to research. Rather, it's a brain reaction that causes you to wake up or become more attentive. Your body is attempting to wake you up by yawning. An interesting experiment!

In 2011, Matthew Campbell and Frans de Waal studied chimpanzees and brought a fresh element to the narrative of yawning. Chimpanzee culture is determined by the social group in which they live. They empathise with familiar group members but not outsiders. So, if empathy explains yawn contagion, chimps should be more likely to yawn while seeing a fellow group member yawn, but not when watching an unknown chimp yawn, Campbell and de Waal reasoned.


Plant
Science

DETERMINING EFFECT OF VARIOUS GROWTH MEDIA ON GROWTH OF *HIBISCUS*

There are numerous options available for growing plants. There has yet to be a study that determines which of these mediums or soil mixtures is best for growing house plants. The purpose of this study is to determine which commonly available medium is best suited for the growth of house plants, as well as whether the application of the biofertilizer inoculum, which is good for the growth of plants and crops, has any effect on plant growth and flowering.



The materials used for the research were 8 plants of *Hibiscus* which were procured from a local nursery, around 20-25 kgs of soil, 2 kgs each of vermicompost and garden compost and biofertilizers bought online with bacteria such as *Azosprillium, Aspergillum, Nostoc,* etc.

Specimens were prepared by mixing different amounts of vermicompost/organic manure/garden compost with soil and biofertilizer inoculum

After the first 15 days of planting, all of the plants exhibited signs of improvement in their health. In comparison to the condition in which they were purchased, a majority of them appeared to be in good health. The leaves of plant specimens 5 and 7 were yellowing and developing yellowish reddish patches. Plant specimens 2 and 3, on the other hand, showed a remarkable improvement in their health and overall condition. The majority of the plants' health showed improvement throughout the research, however, none of the specimens bloomed. This could be since a majority of the research was conducted in December-January. This plant is supposed to go dormant during cold temperatures. During this time, their height did not increase much and after a while, the readings were nearly identical. As to why some plants developed those yellow-reddish spots, it could be due to fertilizer burn, insufficient watering or excessive watering. However, because the plants were watered regularly and there was not as much sunlight present during the colder months, the first two possibilities can be eliminated.

Our findings show that vermicompost and garden compost are about equally good for houseplants and that adding a biofertilizer has no noticeable effect on plant health or flowering.

RIDDHESH AHIRE

TO STUDY THE IMPACT OF ANTIBIOTICS ON PLANT GROWTH

Antibiotics of veterinary origin are released into agricultural fields via grazing animals or manure. Possible effects on human health through the consumption of antibiotic-exposed crops has been intensively investigated. Antibiotics are used to treat infections in humans and animals by either directly killing bacteria or inhibiting their growth. Some antibiotics are highly stable in manure and soil, with their residues still being detectable after one year some may even persist for several years.

Roots are typically affected the most and accumulate the most antibiotics. Antibiotics negatively impact root length, root elongation and number of lateral roots, which consequently affects water uptake. Studies clearly demonstrate that various antibiotics in the soil can accumulate in plant tissues and have either detrimental or enhancing effects. To address this knowledge gap, the effect of antibiotics was studied with respect to the mode of action of Tetracycline on plants such as Moong, Methi and Rayi.
The study shows that cropland species respond to the use of antibiotics, which shows possible effects on yield in farmlands fertilized with manure containing antibiotics.

- Accumulation of antibiotics in the environment can have severe consequences on plants as well as humans.
- From the farmlands, antibiotics may be transported further to ditches, streams and rivers via runoff, to groundwater or may directly be ingested by organisms.

An experimental set up of three plants was done at home. After visible growth was seen, antibiotic Tetracycline was added. Plant shoot length was measured on alternate days.

Plant outgrowth in the presence of antibiotics did not increase as compared to the control plants. But restricted growth, thinning of stems, early wilting, detrimental drying and low yield was observed, resulting in the negative effect of soil degradation and decreased plant production. Antibiotics play a major role in degrading the soil and environment. This study indicates that antibiotics affect the growth and yield of plants by altering their structure and activity. It has become clear that microorganisms that are sensitive to antibiotics are killed or inhibited by antibiotics, which negatively affects the plant growth, structure and soil activity.

MARIAM DADANI

THE ALLELOPATHIC EFFECT OF GARLIC ON TOMATO, CUCUMBER AND EGGPLANT

Allelopathy is defined as the positive or negative effect of one plant on the growth of another plant via the release of chemical compounds called Allelochemicals. Allelochemicals affect physiological processes in plants. Commonly observed effects of allelopathy include reduced germination, reduced seedling growth and reduced root growth. In contrast to this, garlic shows positive allelopathic effects on plants such as pepper, eggplant, cucumber, lettuce and tomato.

Generally, the application of lower concentrations of garlic extract leads to increased root and shoot growth, improved germination and faster overall plant growth. However, at higher concentrations, the effects are opposite and inhibitory. This research project checked for the allelopathic effect of garlic extract on tomato, cucumber and eggplant by observing plant parameters like plant length and leaf area. Due to the allelopathic ability of garlic to stimulate plant growth, it has the potential for use as a biostimulant to improve crop yield and quality. Allelochemicals act as natural herbicides and pesticides as well. Hence, garlic can also be used as an alternative to synthetic pesticides and herbicides without adversely affecting the soil.

The project consisted of two parts; growing the plants in both a regular potted soil setup and a hydroponic setup. For each type of plant, 4 pots/containers were used in each setup. Three of these contained the test samples and one contained the control sample. An original solution was made by crushing garlic (10 grams) and adding the extract to 1 litre of water. From this original solution, three dilutions (1:100, 2:100 and 3:100) were made. Application of the dilutions to the samples was done weekly, along with the measurement of plant length and leaf area.

The results obtained were mixed. Two trends were observed. Initially, the garlic extract had a positive effect on the test samples, showing large increases in plant length and leaf area. However, after this initial rapid growth, the samples died before reaching the 15-day stage. The other trend observed was the death of some samples just a few hours after administering the garlic extract. These trends suggest an overall negative effect on the samples, albeit with an initial positive one.

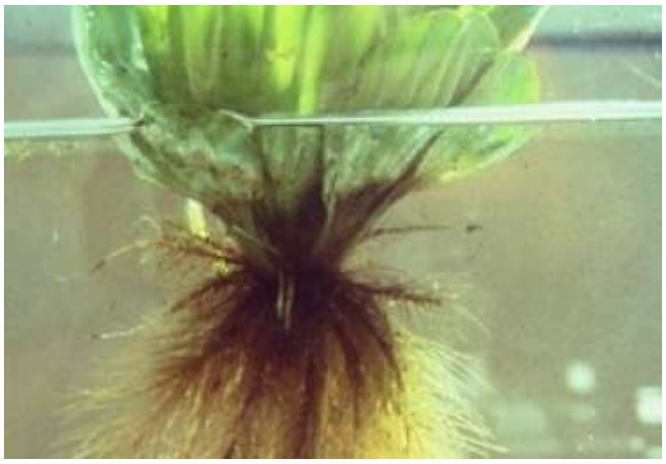
A common observation made for the test samples was shoot and leaf shrinkage, which suggests that the extract similarly affected them. However, the garlic extract could not be confirmed to cause the death of the samples. There could be several external factors that caused the samples to die. This is supported by the fact that some control samples died similarly too.

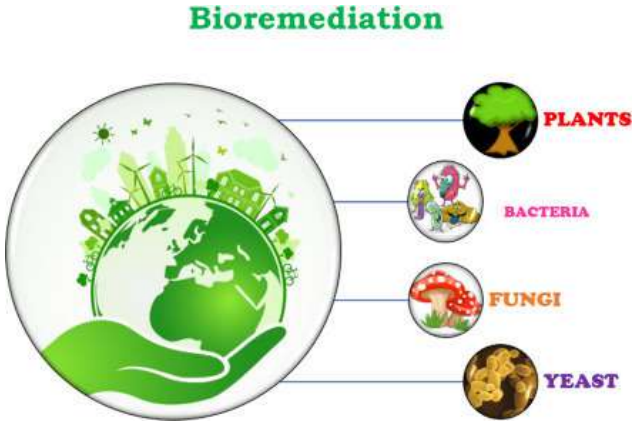
To conclude, the garlic extract showed an initial positive allelopathic effect on the samples, followed by a negative one that most likely (unconfirmed) caused the samples to die ultimately.

ZARHAAN KHAMBATTA

DECONTAMINATION OF WATER WITH PHYTOREMEDIATION

Bioremediation is a natural, environmentally friendly method of cleaning and restoration of environmental pollutants with the use of plants and microorganisms. Phytoremediation, as used in experiment I, is a bioremediation technique in which plants are employed to extract, transport, stabilize and eliminate contaminants from the soil and water.





Freshwater resources on Earth are limited and as human activities increase, various harmful anthropogenic chemicals enter water bodies, contaminating ecosystems and negatively impacting the growth and metabolic activities of plants and aquatic organisms, ultimately affecting the ecosystem as well as human health. Sewage and other waste from agricultural discharges, industrial effluents, chemical companies, fossil fuel facilities and nuclear power plants are the main contributors of water contamination. There are several physical, chemical and biological ways for treating waste water and removing contaminants from it.

The 'Biological Oxygen Demand' (BOD) is the quantity of oxygen consumed by microorganisms to break down garbage. When organic matter is present in water, bacteria in the water begin to break down the waste with the aid of dissolved oxygen in the water, reducing the quantity of oxygen accessible to other aquatic species. A huge amount of organic waste in the water causes a big number of microorganisms to break down, resulting in a high demand for oxygen and a high BOD level.

This will start to drop when the waste is eaten by the water. In this experiment, phytoremediation with the plant *Pistia stratiotes* was used in order to determine the degradation in BOD levels after fourteen days of planting in a water sample.

The BOD value before retaining the plant in the water sample was 0.4mg/l and after planting was 0.38mg/l. As a result, a 5% decrease in BOD readings had been detected. This demonstrates that phytoremediation reduces the amount of organic contaminants in the water, hence lowering the amount of oxygen required for bacterial breakdown.

Due to the extensive time and preparation required for efficient treatment, bioremediation is a cost-effective technique. Modern wastewater treatment plants are highly technological, automated and costly to construct and operate. Optional sewage and wastewater treatment solutions are necessary in most poor nations across the world, including India.

Bioremediation is a new technique that may be used in conjunction with physical and chemical treatment methods to control a wide range of polluted sites and environmental contaminants.

MITTALI SHARMA

MESOCOSMS - AN AID TO ECOLOGICAL STUDIES

The Earth's climate is rapidly changing and human activities are affecting the planet more and more with every passing day. It has become increasingly important to predict climate change and the extent of harm caused by human activities to this world. Mesocosms are small controlled environmental ecosystems enclosed in an experimental set-up. These enclosed set-ups help us to carry out controlled experiments at a small scale in the laboratory to observe its effects and predict the outcomes on the larger ecosystem.

Mesocosms are widely used in ecological studies to help study and find measures to reduce the ill effects of climate change. Research is taking place and is being promoted to calculate and assess the levels of toxins which can be prevented to a great extent. The ecological study carried out in this experiment is to predict the effect of xenobiotic compounds on the environment. Xenobiotic compounds are chemicals that are not naturally produced or expected to be present in an ecosystem. Xenobiotics have become a major environmental concern due to their increasing toxicity. The toxins used in this experiment are a battery, a colorant and a detergent. This experiment was carried out using Fenugreek (*Trigonella foenum-graecum*) seeds. The plants were closely observed for 7 days and the shoot growth of the seeds was noted. 4 mesocosms including the control and the 3 xenobiotic compounds were set up and were also tested for their NPK (Nitrogen, Phosphorus and Potassium) content using a NPK testing kit. The results were compared using statistical tools such as line graph and bar graph. As hypothesized by literature, the results for this experiment are expected to show that the mesocosm set as control results in the most shoot growth of the Fenugreek seeds. Whereas, the mesocosm containing the xenobiotic compounds are expected to inhibit or largely affect the growth of the Fenugreek seeds.. The quicker we find solutions and preventative measures, the better it would be for our Earth. Mesocosm experiments have proven to be quite beneficial to ecological research.

Much to our surprise, according to the seed viability and growth rate, the mesocosm with the battery grew the most. A higher content of Nitrogen and Potassium and a lower concentration of Phosphorus is observed in the mesocosm with the battery than in the mesocosm set as control. A lower concentration of Nitrogen was observed in the mesocosm with detergent. Similar mesocosms were constructed using Aralia (*Polyscias guilfoylei*) saplings. No changes were observed in the vegetative growth of the Aralia plant in either of the mesocosms. No visible changes were seen in the plant with the respect to the concentrations of N, P and K.

IRSHIKAA SHARMA

How Do Ants Communicate?

-Yogita Tiwari

Communication is an important part of our life, but have you ever heard of ants communicating with each other? Surprisingly, yes! They use a multimodal communication system. Ants use pheromones in a number of different ways, such as releasing 'danger' pheromones upon death to alert nearby ants, or to create chemical trails from their nest to promising food sources. Other ants of the colony use their antennae to detect the pheromones and then accordingly respond. Research shows that two chemosensory proteins called CjapCSP12 and CjapCSP13, were expressed in the ants' antennas, and were expressed differently amongst different ant castes (queen & worker). They have a tendency to bind to pheromones.

Another way of communication is via Stridulation, a vibratory signal produced by rubbing the dorsal surface of the first abdominal segment and the plectrum on the posterior edge of the metathorax. This sound produced by ants also helps them to communicate and sometimes to find their mates along with pheromone signaling. Trophallaxis is another important means of communication wherein food is passed to every adult and developing ant. Hence, it indicates that the social network of ants collectively decides their colony development by transferring these juvenile hormones and other molecules through mouth-to-mouth transfer. Isn't it fascinating, how ants use a combination of all these methods to communicate with each other?

Did you get Déjà vu?

Wait a minute, have I read this before? Have you ever had this feeling that the situation you are in has happened before in this exact same order? Well, lo and behold, you are experiencing deja vu.

But what is deja vu and why do we experience this phenomenon? So to begin with, deja vu is a French term for “already seen”, basically a person feeling that the moment they are in has happened to them before. Now, it has been misunderstood for a while as a paranormal concept that could be related to someone making a prophecy but when we talk about it in the terms of science, it is an anomaly of memory where you may feel that the “earlier” experience feels uncertain or something impossible to have actually happened. Deja vu is usually associated with the temporal lobe of the brain, forming a connection with memory. There is a higher chance of experiencing deja vu, when we are tired or stressed due to the clouding of short and long term memory. There are many theories that explain the sensation of deja vu; one of them being how we process and recollect.

Some literature suggests that it can happen in response to an event which may resemble an experience from the past but cannot be recollected. This is related to the process of implicit memory that causes that feeling of familiarity because if you could recollect the similar memory, then you are likely to not experience deja vu.

Apart from this, a study in 1964 suggested that it can occur due to dual neurological processing caused by delaying of signals. Basically the sorting of all incoming signals takes place in the temporal lobe and it receives the signal twice, one by each hemisphere with a delay of a few seconds.

Sometimes the signals may not be properly synced and hence count the experience as two separate memories. As quoted in the movie “Matrix” that deja vu is a glitch, well, it might just be “glitches” in our brain.

- Shruti Anand


Green
Chemistry

PRODUCTION OF ORGANIC FERTILIZER FROM SUGARCANE RESIDUE

Bagasse is a residue from sugar cane processing at a sugar factory. Bagasse produces about 25% of all sugar cane used as a raw material. It is an unwanted and unsellable material derived from agricultural operations related to the cultivation of crops. Once the juices are extracted, the sugarcane stalk is usually incinerated or discarded. Sugarcane residues have excellent organic soil compost properties and can be used in soils that are low in organic matter and help in increasing soil fertility.

The objective of this research was to test the possibility and feasibility of producing organic fertilizers from the waste streams generated from the agricultural phase of sugarcane, as an environmentally friendly reusable alternative to produce organic fertilizer that is safer and environmentally friendly than chemical fertilizers. Experiments have shown that organic fertilizers can be made from a combination of residues produced from sugar cane residues according to their chemical and biological properties.
The materials used were bagasse, Soil, Water, Egg Shell, Leftover Carrot, Beetroot Waste, Cow Manure, Containers, Roots of *Pandanus amaryllifolius* (pandan) plant and Roots of Mint. Composting was carried out by the following method, but since bagasse contains a large amount of water and water content plays an important role in compost production, bagasse was exposed to sunlight for one week to reduce the water content. Composting using aerobic decomposition is a process that uses oxygen and releases carbon dioxide, water vapor and heat.

Every week, the compost was emptied from the Bucket and manually turned, watered and then packed again in the Bucket. The process continued for around two weeks, by checking the moisture content, adding the required water and then kept for fermentation. The composting process was completed in a month based on watering, compost mixing, monitoring the temperature of the compost treatment and observing the physical appearance of the compost

Bagasse Fertilizer was used to grow mint leaves (pudina). The roots of pudina were potted in the soil and were watered with a sufficient amount of water and proper sunlight was given to it. The reason for this is to check whether the fertilizer is ready or not. After a few days, growth was observed which gives us an idea that the fertilizer is now ready to be used by other plants.

IZZA MAPARI

STUDY OF THE EFFECTS OF FERTILIZERS ON *Daphnia Pulex*

Fertilisers are designed to be water-soluble so that they can dissolve into the soil. When more fertiliser is applied than crops, the excess seeps into groundwater supplies and is then discharged into water bodies harming aquatic life. *Daphnia* is the model organism chosen for studying the effects of fertilisers. It is commonly called water fleas, are small planktonic crustaceans and are ubiquitous in freshwater aquatic environments. Urea, potassium chloride, and di-ammonium phosphate are the fertilisers chosen for the research

Urea is a source of Nitrogen, an essential nutrient crucial for crop growth and development. Di-ammonium phosphate is a preferred fertilizer because it contains both Nitrogen and Phosphorus which are primary macronutrients and part of 18 essential plant nutrients. Potassium chloride is a metal halide salt composed of potassium and chlorine. Research on the effect of these fertilizers on *Daphnia* will aid in determining the negative effects they have on aquatic life. Fertilizer runoff has a negative impact on aquatic systems because it can cause major disruptions and imbalance to the local ecology and also fuel the growth of massive harmful algal blooms, these can have several serious consequences for humans and the environment. When manure or commercial fertilizers enter surface water, the nutrients they release stimulate microorganism growth which reduces the dissolved oxygen content of the water body. Without sufficient dissolved oxygen in surface water, fish and other aquatic species suffocate. The resulting dead fish and other aquatic species degrade the water quality and cause unpleasant odors

Every year, pesticide use causes the decline of fish and other aquatic species. Fish and other wildlife species have been victims of pesticide poisoning by consuming toxic plant materials or aquatic species.

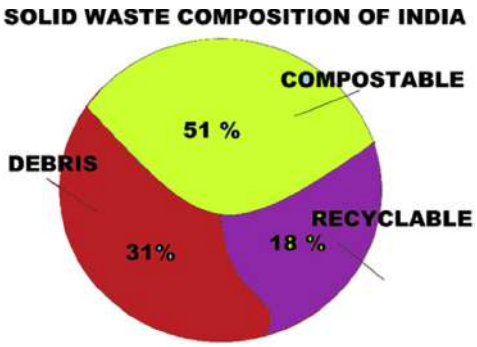
This research showed how poisonous fertilizers have a bad impact on *Daphnia*. The maximum mortality rate was found at 0.1 M urea concentration, whereas the lowest was found at 0.01 M di-ammonium phosphate concentration.

The death rate of *Daphnia* increases as the concentration of urea increases. While there were no dead daphnia in the initial concentration of di-ammonium phosphate, the mortality rate increased as the concentration increased, indicating that the number of *Daphnia* was decreasing. High potassium chloride concentrations have negative consequences on daphnia resulting in the organism's mortality as the concentration rises. Urea has the most negative impact on *Daphnia*, while potassium chloride is the second harmful substance. These fertilisers caused an increase in heartbeat in the early phases, but they killed *Daphnia* over a period of time.

JAFRIN SAYED

PREPARING MANURE FROM KITCHEN WASTE AND MONITORING THE EFFECT ON *Hibiscus*

Waste disposal is a major concern of the society so composting is a natural process of decomposition and recycling of organic substances into humus-rich soil which is called 'Compost'.



The temple waste is released into the water bodies or dumped at the available places of land which creates severe environmental pollution and health hazards. Floral waste is biodegradable and contains elements required for the growth of microorganisms.

- On long term application, manure helps to reduce the loss of soil by wind erosion, reduce surface run-off and make soil water more available to plants.
- The application of manure and trace elements has enabled large areas in many parts of the world, which were formerly waste, to be brought under cultivation
- It is an effective and eco-friendly way of disposing of food waste in your kitchen which improves soil fertility and enhances crop productivity.

The materials and methods used in the following experiment are:

Peels of potato, banana, apple and peas. Leftover fenugreek and tea waste and coconut husk. Leaves of almond trees, soil, water and curd.

Marigold, Rose, Jasmine, and *Hibiscus* were among the floral waste gathered from temples. Soil samples were taken from several gardens to isolate microorganisms capable of decomposing flower waste. After collecting fruit and flower waste, non-biodegradable garbage, such as plastic, paper, and thread was separated from biodegradable waste by hand sorting. The air-dried samples were then crushed and ground into a fine waste using a mixer grinder. The compost is turned over on different days such as the 10th day, the 20th day and the 30th day. All the waste is then mixed then a small amount of curd is added. Curd has favorable bacteria which helps in nurturing the plants. Then the mixture is kept under the container by covering with a lid for 1 month. Then after a month, the effect of the compost on the plant is seen. On the 10th day, the compost started to turn black. After the 30th day, the compost is ready and it has already turned black in color with an ordinary smell.

Two *Hibiscus* plants were studied. Initially, the plant was very small, hence compost was added. In plant 'A' the compost added is very small in quantity whereas in plant 'B' it was more than 'A'. As a result, in plant 'A,' the plant grows slowly since just a small quantity of compost is supplied to the hibiscus plant. Plant 'B' has a significant amount of compost added; thus, the *Hibiscus* plant is seen growing quickly.

AKANKSHA SINGH

PHYTO-POWER

Imagine lighting up your balcony with electricity generated by living plants, sounds incredible! Plants generate electricity with the help of a process called photosynthesis where food is generated. Plants store glucose as starch in the xylem parenchyma ray tissues of their roots. Soil microbes near them break this down, which generates electrons by forming microbial fuel cells. These electrons are caught using zinc and copper electrodes to harness the electricity without harming the plants.

This research used 5 types of plants consisting 5 of each type(Marigold, Cactus, Periwinkle, Onion and Guldaudi.) The day was divided into four sections; Morning (9AM - 12PM), Afternoon (1PM - 4PM), Evening (5PM - 8PM) and Night (9 PM -11 PM).
The electrodes used were inserted near the root of plants and were connected in series. Voltage of each plant combination was observed for 3 days. The study focused on finding the best plant, timing and weather conditions to generate high amount of electricity . We used 2 volts LED bulbs to analyze whether the electricity can be used practically or not.
As we all know, energy demand will increase with increase in population and fossil fuels are unsustainable sources of energy because of their limited availability and environmental impact. Electricity generation from them contributes to pollution, hence this research can encourage the growth of more plants as a source of power lowering the and ultimately pollution levels. It will benefit rural areas by increasing their access to inexpensive energy sources. As the government continues to focus on trying to provide an affordable energy source, this can open many career opportunities for people.

Optimum plant: Onion, because of its high acidity and low photorespiration; generating around 4 volts of electricity and was able to light up an LED bulb. Study also suggests using marigold and cactus due to its high voltage output. Guldaudi was not efficient, because its soil is sandy and shows resistance towards electron flow.
Best time: Afternoon and night. Good light intensity, water and temperature are necessary here, as photosynthesis depends on this.
A drop in voltage was observed in the evening for all plants due to non-photochemical quenching (Mechanism used by plants to overcome the stress of excess light by releasing it in the form of heat).

The study proves that we can use living plants to generate electricity without harming them and without generating pollution.

YOGITA TIWARI

DEVELOPMENT OF ECO-FRIENDLY BIOFERTILIZER USING CO-COMPOSTING METHOD

Chicken feathers are part of agricultural waste, and about 5 million tons are produced as a waste stream per year during meat processing. They are frequently burnt or buried in landfills, creating a waste disposal issue and an environmental contamination danger. The aim of this research is to create an eco-friendly biofertilizer using organic waste and chicken feathers by co-composting, as well as to analyse the growth and development of chickpea seedlings.

Controlled aerobic decomposition of organic compounds involving more than one feedstock is referred to as co-composting. High agricultural productivity is required to meet the increasing demand of the population; this can be fulfilled by co-composting as it encourages increased crop yields in agricultural crops. Landfills of organic wastes usually produce methane; a strong greenhouse gas that when released has the ability to trap heat in the atmosphere thus contributing to global warming. But by this method of composting, we can reduce the methane emissions and carbon impact considerably. The compost was made from chicken feathers and organic waste. They were introduced to each pot containing 7 chickpea seeds after 60 days of compost preparation, and their growth was recorded. The temperature changes show that the response that occurred here is aerobic respiration.

The temperature reaches a peak for about a week before progressively decreasing and reaching a maturation stage. Before composting, the pH of all treatments was about 6.0, and after composting, it was around 7.5. After 60 days of composting, the physicochemical properties of the treated soils revealed an increase in nutrient content, particularly raw feather and copra meal, which is the T3 treatment. When the before and after NPK analysis data were compared, there is a general rise in the NPK content of the soil that can be noticed. These NPK results could explain the 100% germination rate and differences in leaf and stem length in the T3 treatment against the other. For the Chicken feather+ Copra meal(T3) treatment, the growth parameters stem length, leaf length, number of leaflets, and root system per plant are at their maximum.

By comparing the NPK results, germination rate, and overall development, we can conclude that T3, a co-compost of copra meal and chicken feather, provides the best overall growth of the chickpea plant.

PRANALI MANI

STATISTICAL ANALYSIS: EFFECT AND PERCEPTION ABOUT AIR POLLUTION IN MUMBAI

Air pollution is the release of air pollutants in the air which deteriorates the quality of air and also causes various problems. Slowly, it is becoming one of the major health issues which is affecting people around the world. According to the World Health Organization, more than 2 million people die each year because of air pollution. It not only impacts the climate, but also greatly affects the public health.

This study will help us understand the effect of air pollution on ground level in Mumbai. Also, it will be beneficial in understanding the thinking of people regarding air pollution. This type of study helps the government to form policies and initiatives and can also act as starting material for various research work.

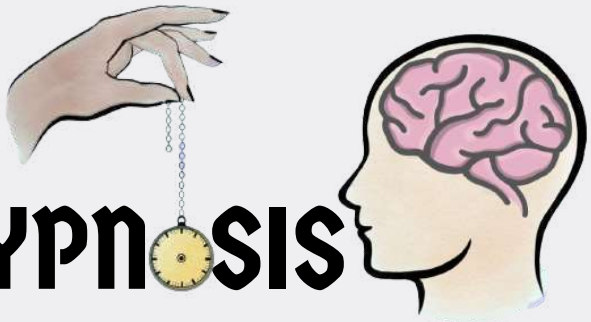
In order to get insights on the effects and perception of air pollution among people, a survey was conducted. This survey was conducted among the people of Mumbai. The survey included questions regarding the effects and perception of air pollution. The questions were framed in a way to check how people are being affected because of air pollution. A total of 75 responses were collected. The results of the survey were then presented in the form of 100 percent stacked bar graphs and pie charts for further interpretation. This was done using Google Spreadsheet and Microsoft Excel.

More than 70 percent of people always or sometimes feel the problem mentioned in the 100 percent stacked bar graph. From the survey it is clear that it has now started affecting the daily life activities of people in Mumbai. Above 50 percent of people know someone who has suffered or suffered from asthma and about 33 percent from lung disease. Results show problems related to air pollution are getting more common these days. We can also conclude from the survey that there is less awareness regarding laws related to air pollution among people with only 58.7 percent knowing about them. Regarding the perception report, most people feel that they have not done enough on their front about problems related to air pollution and think the same for the government. Air pollution is rising very rapidly and there is an urgent need for public-government co-operation to bring it down.

More extensive research should be conducted across institutes in India and abroad to bring out innovative ways to tackle this problem. Governments should be stricter and create more strict laws regarding air pollution. People on their front should be more careful and try to avoid activities that lead to more air pollution.

ADITYA VERMA

HYPNOSIS



Hypnosis has been an unanswered mystery for over more than 200 years and science is yet to come up with an actual explanation to solve this puzzle. It is a highly misunderstood territory with multiple false stigmas revolving around it. One of them being that a person loses all their free will and goes under complete control of the hypnotist. Hypnotism can only work on people who want to get hypnotized and believe that they can get hypnotized. Even under the effect of hypnosis, you can never make a person do something that they don't want to do.

Researchers claim hypnosis to be a method with which you can directly be in touch with your subconscious mind. Electroencephalographs (EEGs) of people under the influence of hypnosis showed an increase in the lower frequency waves of the brain which are associated with sleep and dreaming and a decrease in the higher frequency waves of the brain which are associated with wakefulness. This suggests that when hypnotized, the brain is aware but less alert. On studying the various patterns of the cerebral cortex, it was also observed for a person under hypnosis that there is reduced activity in the left hemisphere which operates on logic and reasoning, whereas there is elevated activity in the right hemisphere which operates on imagination and creativity.

Hypnosis is a more common phenomenon than you think, we hypnotize ourselves on a daily basis when we turn to TV series/movies, music or escapes of such sort which make us so engrossed in them that we forget about our actual worries and relieve us from day to day stress. This trance-like state of not being worried and more carefree is known as the state of hypnosis.

- Irshikaa Sharma

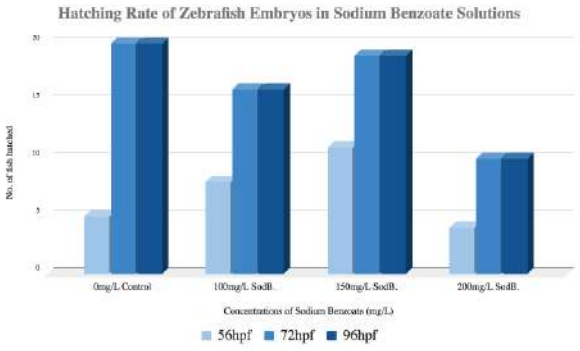

Animal
Science

TOXICITY EFFECTS OF FOOD ADDITIVES ON ZEBRAFISH'S EMBRYO

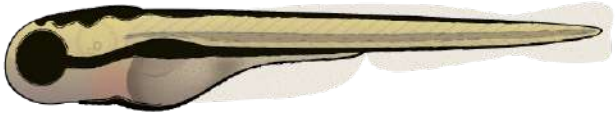
The advent of food preservation has solved many food-borne diseases and it also increased food security over the years around the globe. One of the biggest concerns of people all over the world is the inclusion of food preservatives and chemicals in everyday food items. The produced food is functional, convenient, and enriched, which is achieved with food additives.

Scolisis in 200mg/L SB at 96hpf with slight yellow pigmentation

Pericardial Edema (PE) in 200mg/L SB at 96hpf



Nowadays, food additives are very widespread in the human diet, but not all of them are synthetic and invasive on human health. Because of some of its controversial effects on human health, sodium benzoate (SB), the most commonly used chemical preservative and Sunset Yellow FCF a commonly used food colour, have attracted increased attention. Studies have shown a high intake of beverages containing SB and food colours can cause ADHD symptoms such as hyperactivity and impulsiveness.
Sunset Yellow FCF is an azo dye, it can also aggravate allergies and trigger skin reactions. All food additives, and their application and dosage, are subject to strict regulations. The purpose of this work was to investigate which food additives are the most common in our everyday diet and how they affect our health.
This study aims to investigate the toxic effects of these additives on the development, behavior and oxidative stress in zebrafish embryos. Zebrafish (*Danio rerio*) is a freshwater fish and a widely used vertebrate model for research studies. Because of their rapid development and external fertilization, they are emerging models for studying developmental toxicology. The embryos are transparent, allowing for observation of their development under a microscope. They produce hundreds of offspring at a single time. Zebrafish is also a validated model for performing behavioral experiments since behaviour is associated with neuronal development. Its brain has a structure that is extremely similar to that of humans.



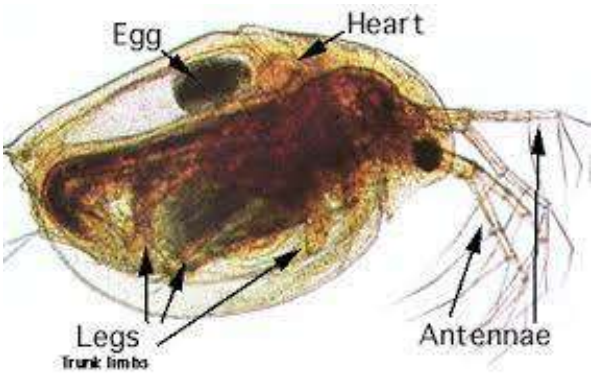
The zebrafish embryos of 5hpf (hour-post fertilisation) were exposed to varying concentrations of SB and Sunset Yellow and their developmental and behavioural changes were studied.

The studies indicated that SB induced morphological abnormalities like pericardial edema, yolk sac edema and tail bending (scoliosis). The malformations were more pronounced with the increase in dosage of chemicals and their time of exposure. SB was also found to delay the hatching process and increased the mortality rates in higher concentrations. The behavioral experiment indicated increased thigmotaxis in treated larvae. This study strongly supports that there are teratogenic effects on vertebrates at increasing doses. Thus, we suggest caution in the extensive usage/consumption and frequency of this preservative in processed and convenience foods, particularly by gestating women.

ANUSHKA PAI

TO STUDY THE EFFECTS OF OTC DRUGS ON *Daphnia Pulex*

In the age of global climatic change, increased industrialization and over-exploitation of natural resources, many ecosystems, and the biodiversity they support, are at a tipping point from anthropogenic stress. The topic chosen for my experiment is to study the effect of various over-the-counter (OTC) drugs on the heart rate and locomotion of *Daphnia pulex*.



The drugs used were Pseudoephedrine, Aspirin and Benadryl. *Daphnia* was chosen as the model organism for this experiment. They have a transparent body which makes it possible to conduct bioassays using endpoints other than death. It is possible to measure their heart rate and movements, which are signs to measure stress. This study will help analyze the adverse effects that OTC drugs have on aquatic life and how harmful they are to them. The information gained from this experiment could help people understand how important it is not to dispose off wasteful products into our rivers and streams, because of the way it affects the food chain.

The study conducted thus concludes that different classes of drugs have different effects on the heart rate as well as the movement of *Daphnia*. Bradycardia was observed for Benadryl whereas tachycardia was observed for aspirin and pseudoephedrine. It also draws a conclusion that the duration of time does not alter the effects of the drugs on *Daphnia*. However, it was found that the same concentration of different drugs may affect *Daphnia* differently. Some drugs may have a more lethal effect on the *Daphnia* while the same concentration of another drug can have milder effects. This is proven to be correct by the study conducted because the same concentration of Benadryl, Aspirin and Pseudoephedrine had a varying effect on the mortality rate.

The results obtained supported the hypothesis that the *Daphnia* exhibited a change in heart rate when exposed to the OTC medication used and inflicted bradycardia or tachycardia effects in them. The results proved that over-the-counter medication did have an effect on *Daphnia*'s heart rate, movement and mortality rate. After understanding the effects they exhibit on small organisms like *Daphnia*, we can only fathom how they might affect other aquatic organisms. It is possible that these drugs can have similar or more drastic effects on humans, if taken more than the advised dosage. Thus, pharmaceuticals monitoring data in marine waters are necessary to assess water quality and to allow enhancing future regulations and management decisions.

JHEEL POPAT

MITOCHONDRIAL GENOME OF *Varanus komodoensis*

Scientists have found the link between mammal hair, bird feathers and reptile scales, which is said to resolve the decades-long scientific debate as to how these skin coverings have evolved. Just like this, there is a huge question and curiosity to understand the relation of mammals and reptiles. In this report, we will try to understand the divergence and the relation between these two vertebrates.

Mitochondria have a double membrane, they are a double-walled structure. The membrane around the mitochondrion is different from the one around the rest of the cell. It is this membrane that keeps the mitochondrion separated from the rest of the cell. Mitochondria are small organelles that are found in the cytoplasm of cells that contain their own genome, the mitochondrial DNA (mtDNA), which is located in the mitochondrial matrix.

Mitochondrial DNA (mtDNA or mDNA) is the DNA positioned in mitochondria. They are mobile organelles inside eukaryotic cells that convert chemical energy from food into a form that cells can use, it includes adenosine triphosphate (ATP). Mitochondrial DNA is only a small part of the DNA in a eukaryotic cell.
Mitochondrial DNAs (mtDNAs) of vertebrates are 16–18 kbp double-stranded circular DNAs. They encode genes for 2 rRNAs, 22 tRNAs, and 13 respiratory proteins collectively with the main non-coding region or the control region that is responsible for replication and transcription of the mitochondrial genome. Unlike nuclear DNA, which is inherited from both the parents, mitochondrial DNA is inherited solely from the mother.

Considering the data we have in present we can say that both the organisms are diverse in many ways, be it structurally, functionally or morphologically but the mitochondrial genome in both the classes is very much conserved.

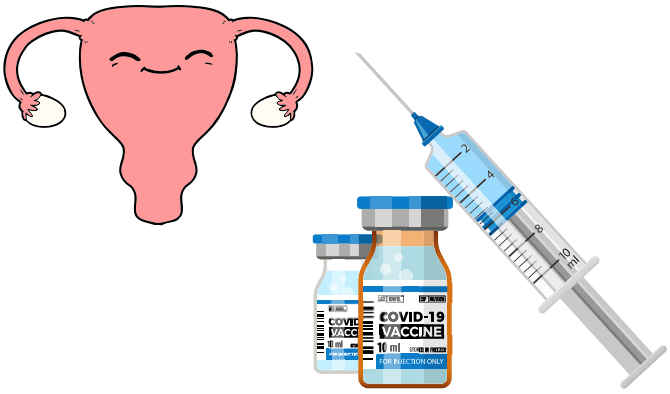
By comparing the sequences of genomes of different organisms, researchers can understand what distinguishes different life forms from each other, at the molecular level. Aligned sequences are used for many purposes, including estimation of patterns of divergence, selection, the tempo and mode of evolutionary change, phylogenetic history, identification of functional elements and constraints, just to name a few. Sequence alignment is the first step in molecular phylogenetics, aiming to identify site homology (co-ancestry). The aligned sequences can be further studied to trace back the common ancestor of the reptiles and mammals to understand the evolutionary aspect of the development of vertebrates.

UNNATI BADGOTRI

ASSOCIATION BETWEEN COVID-19 VACCINATIONS AND MENSTRUAL CYCLE LENGTH USING BIOSTATISTICS TOOLS

Many females after taking their COVID-19 vaccination shots have experienced many menstrual problems like heavier than usual periods, delayed periods, and unexpected vaginal bleeding. This study will help us determine whether there is a genuine link between the COVID-19 vaccines and menstrual changes in a female's cycle length and period length, or if the observed changes are due to another factor.

The study can help provide women with more information about what to expect during their menstrual cycles after receiving COVID-19 vaccinations while also ensuring that no negative or unintended side effects occur in females. Studies and research in this field are important as clinical trials of the current COVID-19 vaccines did not collect menstrual cycle outcomes post-vaccine.



The data for this study was collected using Google Forms, then the processing and analysis of the data was done using Excel. Correlation analysis was performed between the average of the two pre-vaccination cycle lengths and one post 1st vaccination cycle length. Then correlation analysis was performed between the average of the two pre-vaccination cycle lengths and one post 2nd vaccination cycle length. Similarly, correlation analysis was also done for period length for those individuals.

From the coefficient of correlation values and scatter plot diagrams obtained we concluded that there is a strong relation between COVID-19 vaccines and cycle length as well as period length changes. A possible reason for such menstrual changes could be a triggered immune response because of the vaccinations. Because the cycle is supported by the immune system, vaccines designed to elicit an immune response against COVID may temporarily alter the normal course of events. For example, an activated immune system might interfere with the usual balance of immune cells and molecules in the uterus. Menstrual characteristics are not static, and variability exists month to month across an individual's lifespan, thus studying them or performing experiments on them has a lot of variables like environment, health stressors, lifestyle changes to consider. Thus, making it difficult to conclude if a particular factor was responsible or not unless the research is done on a biological level.

The lack of population-level, prospective evidence about the relationship of COVID-19 vaccination and menstrual cycles limits our ability to sufficiently address these concerns and to counsel individuals who menstruate about what to expect after taking the vaccination. More research and experiments need to be done on this particular topic to get stronger conclusions. Other menstrual symptoms, such as unscheduled bleeding and changes in the amount of menstrual bleeding, should also be investigated. Post-menstrual changes should be studied in future clinical trials of other vaccines.

KAIZEEN BALSARA

STATISTICAL ANALYSIS OF FACTORS INFLUENCING TOBACCO/CIGARETTE ABUSE

Cigarette smoking remains one of the most significant preventable causes of disease and premature death in the western world. It is a leading cause of death from cancer. There's no way around it; smoking is bad for health. It harms nearly every organ of the body, even some unexpected ones. Cigarette smoking causes nearly one in five deaths globally. It causes lung and oral cancer and even diseases such as Chronic Obstructive Pulmonary Disease (COPD), emphysema and asthma.

Smoking causes addiction to nicotine, a stimulant drug present in tobacco. Nicotine addiction makes it much harder for people to quit smoking. Besides cigarettes, there are other forms of tobacco, such as cigars and hookahs, which contain other harmful chemicals along with nicotine. The purpose of this study is to determine the factors that entice people, particularly youth, towards such abuse and attempt to create a healthy and cigarette/tobacco free society.

A prospective observational survey of a group of people on tobacco/cigarette abuse was conducted via a Google form survey. The questionnaire contained questions on the ill effects of cigarette/tobacco use. Participants from different backgrounds participated in the survey. The sample space was approximately 55-60. The responses were analysed using statistical graphs from Microsoft Excel (bar graphs and pie charts).

Tobacco abuse and cigarette smoking is a major challenge in the 21st century. Smoking is one of the main causes of lung cancer, emphysema and asthma. Smoking and chewing tobacco is the prime cause of death globally. This project aims to study the different factors that entice people into vicious circles of abuse and understand the perception of people towards cigarette/tobacco use.

The project focuses on measures to increase awareness among society on substance abuse. It also aims to design and promote a healthy environment and protect youth from the ill effects of tobacco and cigarette smoking.

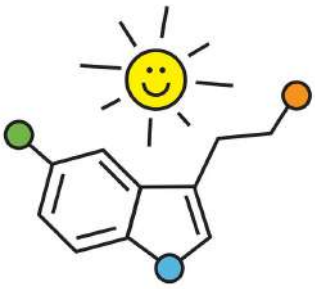
This survey's outcome determined the factors which entice individuals towards abuse, which include euphoria, need for adventure, etc. The study revealed that the first use of drugs is out of curiosity or experimentation. Other factors associated with cigarette abuse are societal and academic pressure. 76.3% of people believe that tobacco/cigarette abuse can be prevented by avoiding peer pressure, educating and counselling youth, seeking help from parents and peers and even seeking medical help.

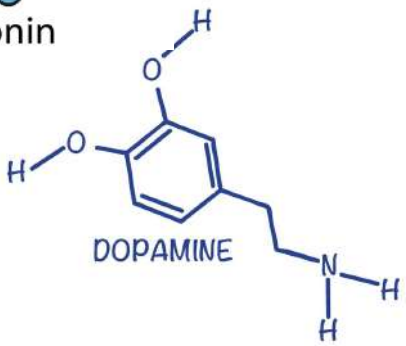
VINAY CHANDEKAR

IMPACT OF SEROTONIN AND DOPAMINE ON GENERALIZED ANXIETY DISORDER

This study revolves around understanding the role of Serotonin and Dopamine (the feel-good hormones) on anxiety levels in a person. Both of these hormones are known as mood stabilizers, but it has been noticed that a rise in levels of serotonin elevates the anxiety in a person, whereas the elevated levels of dopamine, had no such effect. So, the question arises, why does one mood stabilizer when present in abundance worsen the anxiety symptoms in a person whereas the other does not?

Through extensive literature review and research, this study has tried to understand the neurological pathways and effects of each of these mood-stabilizing hormones and consecutively understand their effect on the general mood of a person suffering from Generalized Anxiety Disorder (GAD). The study included 45 people, 20 of which followed a cure tailored specifically towards their anxiety symptoms while the other 25 did not particularly do anything about it. Throughout one-month, various activities known to promote the production of serotonin and dopamine were assigned to these people and their immediate effect was noted down through the survey. This gave us a chance to compare whether pre-existing methods along with these mood stabilizers enhanced the feeling of euphoria in a person suffering from GAD. Simultaneously, the phylogenetic history of common serotonin and dopamine receptors was studied to understand their relationship with each other and their function.





- The group which followed no pre-existing management method for anxiety, felt no major difference.
- The group that did have a pre-existing management method felt a major decrease in anxiety symptoms post such activities.
- Although dopamine and serotonin do not ascend from the same ancestral root, they show a 40.77% similarity genetically, explaining their similar function. However, an inhibitor less known in our blood SSRI (Selective Serotonin Reuptake Inhibitor) was shown to have altered functioning causing increased serotonin levels in the blood to worsen GAD symptoms.

The study shatters the myth of serotonin being the happy-hormone. Many people rely on their body's natural ability to produce such mood stabilizers not realizing that these same hormones could worsen their symptoms. Anxiety being so widespread, greatly eats away from high quality of life, cannot be cured or eradicated but can be managed. This study was a step towards understanding our body's neurological response and any step taken is a step in the right direction.

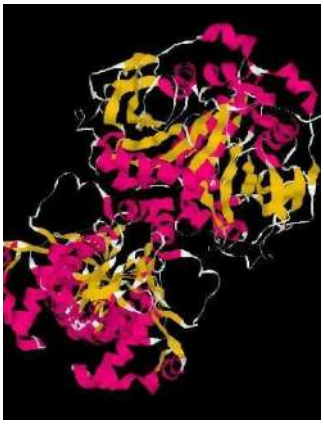
LABDHI JAIN

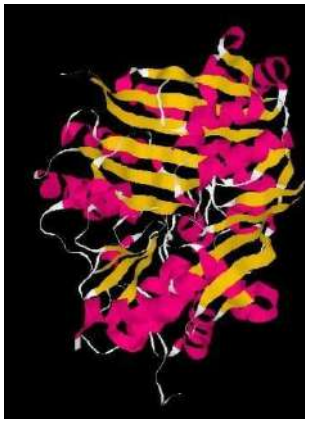
COMPARATIVE STUDY BETWEEN FOR *Cannabis sativa* AND *Cannabis indica* ACOX2 GENE

The study covers a comparison between *Cannabis sativa* and *Cannabis indica* with the help of bioinformatics tools and a comparison between the 3D structure of ACOX1 (previous historic version of ACOX2) and ACOX2 (recent version).

Weeds are the most destructive enemy of agriculture, known as “a plant in the wrong place”. They are unwanted and undesirable plants which grow naturally anywhere. It's the reason for the sudden rise in prices of fruits and vegetables in the market. This severely affects the economic conditions widely.

Cannabis Sativa and *Cannabis Indica* are weed types which have benefits and side effects and are dependent on the ACOX2 gene. This gene is responsible for differences seen in structure and effects of both *Cannabis*. Comparative study between *Cannabis Sativa* and *Cannabis Indica* by analyzing ACOX2 gene is responsible for differences seen in structure and benefits of both *Cannabis* will help to get better information. We would get solutions to problems caused due to weeds and also be able to look forward to achieving beneficial uses of weeds. e also went through the details of the ACOX1 (ACOX2 gene before evolution) and checked the gene sequencing for same.





However, results showed error and hence we took this research more forward and checked its 3D structure where we can clearly see the difference in way how densely condensed the gene. ACOX1 had the less dense structure and ACOX2 have very dense structure comparatively. Difference in the chromosome number of ACOX2 gene in Cannabis Sativa is on Chromosome 9 and that of Cannabis Indica is on Chromosome 7 which makes one assume that this could be the one of the reasons that we see the structural difference in length, height, width, leaves color, etc.

Another difference was exon count. In *Cannabis Sativa*, the exon count is only 1 whereas in *Cannabis Indica*, the exon count is 15 which itself is a huge difference. These differences can be the reason for the different effects and other differences between them.

After comparing the ACOX2 gene of *Cannabis Sativa* and *Cannabis Indica* results, we conclude that ACOX2 known for the structural, medicinal properties, relaxing and stimulating effects is 100% identical in both the genes. So, we can say that other factors or the concentration/location of the gene is responsible for the different effects.

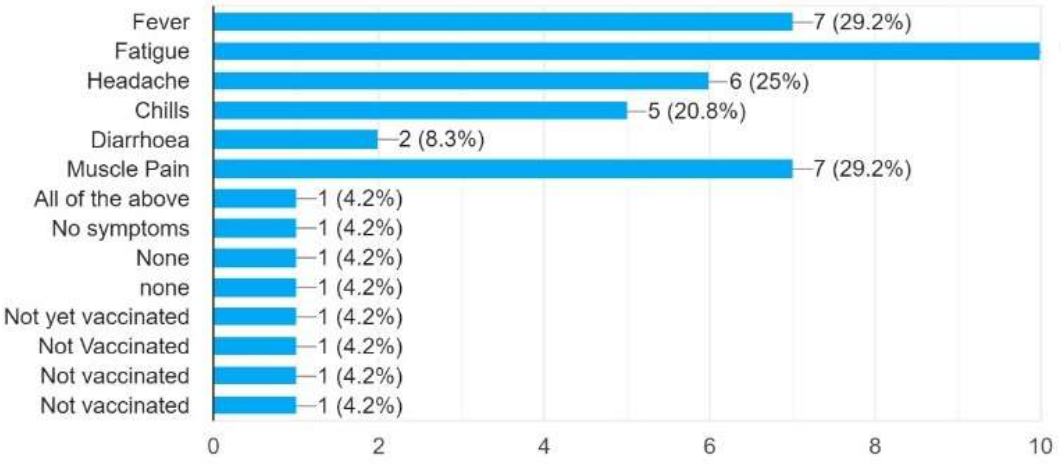
TANVI SONKUSARE

STATISTICAL ANALYSIS OF SIDE EFFECTS OF COVID-19 VACCINES

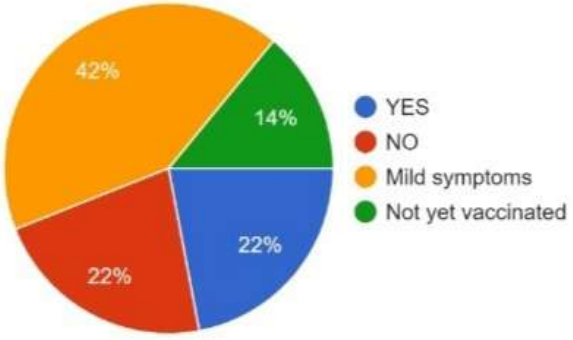
The year 2020 will be remembered in modern history as the most challenging year in terms of combating SARS CoV -2, a viral infection which caused intense respiratory illness, COVID-19 originated first in Wuhan city, China. A novel coronavirus was identified as the cause by Chinese authorities on 7th January 2020 and was temporarily named 2019- nCoV. It was further known as SARS-CoV2 (severe acute respiratory syndrome coronavirus 2).

From the initial stage of this pandemic, scientists were focused on either repurposing the existing drugs or developing vaccines against COVID-19. As of January 20th. 2021 one hundred and seventy-three vaccines were in pre-clinical trials, by January 2021 emergency approval was granted to nine vaccines by regulatory authorities in different parts of the globe

A survey was conducted using Google Forms. Understanding what were the side effects of the vaccine and was it normal in young individuals and adults. The responses were analysed with a pictorial representation using Microsoft Excel/Google Sheets for pie charts and bar diagrams. Statistical graphs were used to represent the collected data to make it easier to understand and interpret the statistical information.



Right now there are a lot of vaccines out there in the market. Some of the vaccines are Covishield, Covaxin, Sputnik, Pfizer etc. Fever, headache, fatigue, and pain at the injection site were the most commonly reported side effects, and overall, most side effects were mild to moderate. However, as with the two-dose or single-dose primary shots, serious side effects are rare but can occur.



The study reveals that vaccination is important for every individual. At least by vaccinating oneself, people will be less prone to COVID-19 as compared to those non-vaccinated. Reported side effects to COVID-19 vaccines have been mild and mostly short-lasting including fever, headache, muscle pain, chills, and pain at the injection site. In most cases, these can be managed with rest and paracetamol.

AKASH SANGA

COMPARATIVE STUDY OF PAX7 GENE IN ZEBRAFISH AND MEDAKA

An organism's pigment pattern is of keen interest to evolutionary biologists because of its ecological and behavioral significance.

The pigment cells found in the dermis of fish belongs to six categories- melanophores (black), xanthophores (yellow), iridophores (iridescent, silver, gold, blue), leucophores (white), erythrophores (red) and cyanophores (electric blue). In Danio rerio, we find three classes of pigments i.e., melanophores, iridophores and xanthophores whereas, in Medaka, one extra class of leucophores is present. The xanthophore differentiation and lineage is controlled by many genes. One such gene is Pax7. It plays a crucial role in the development of precursor cells during neural crest cell differentiation. The distribution of pigment organelles within pigment cells is crucial in determining the general colouration of the body. Shoji Fukamachi and his colleagues observed courtship rituals and female responses among the transgenic and wild medaka fishes. They concluded that an increase in xanthophore patterns acts as a love potion between both the sexes. So the comparative study of this gene can help us with cellular behaviors, genetics, ecological and evolutionary mechanisms.

Nucleotide sequences of the Pax7 gene present in Medaka and Zebrafish were aligned using sequence alignment tools such as Blastn, Needleman-Wunsch, Smith-Waterman and Clustal Omega.

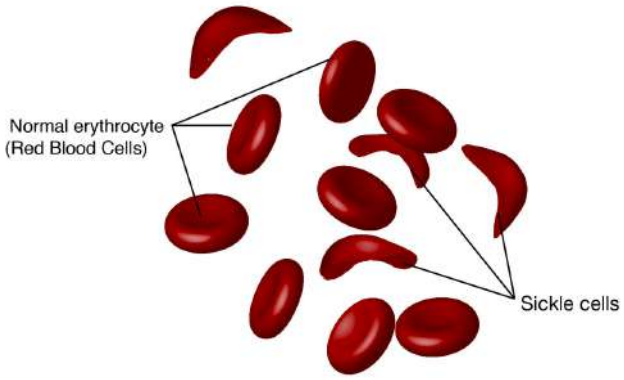
The results derived show that the two sequences are moderately similar to each other when local alignment tools are used. The nucleotide sequences are less similar to each other using global alignment tools. The sequence alignment in Clustal Omega shows that the bases are highly conserved and selected by nature. The function of the Pax7a gene remains intact to an extent in both species but there are a lot of dissimilarities between the two as shown by the Needleman algorithm.

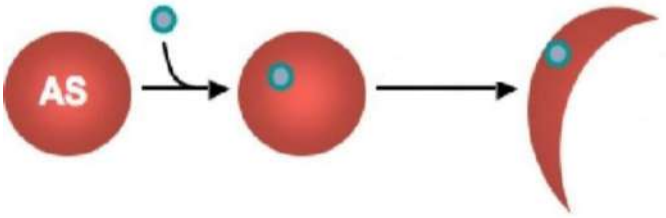
This justifies the fact that the Pax7a gene is not only responsible for xanthophore differentiation but also leucophore differentiation in medaka. Moreover, the moderate similarity also justifies that pax7a plays an important role in the xanthophore lineage of both fishes. But this research is based on the pre-existing strains of the gene. No mutant Pax-7 genes are analyzed so it will not be entirely true for the variant species arising in nature by selection. But this lays the foundation for future related studies to find out some key significance in the evolution of this gene as it will give us an appropriate understanding of pigmentation in natural selection and reproductive fitness. It's quite a miraculous potion to understand fish mating and behavior.

MANALI CHAKRABORTY

STUDY OF ASSOCIATION BETWEEN HBS ALLELE AND PARTIAL RESISTANCE TO MALARIA

Sickle cell disease affects hemoglobin, the oxygen transporter in the body, and is a category of genetic red blood cell abnormalities. Red blood cells are normally disc- shaped and our blood arteries are able to flow freely. Sickle cell disease, on the other hand, affects the red blood cells. The form of the cells changes to a crescent or "sickle" shape. These cells are difficult to bend and flow, and they can rupture.





The materials used for the study were online Bioinformatics tools like Genbank and Clustal Omega. Genbank was used to derive the sequences of wild type *Homo sapiens and Pan troglodytes* and sickle cell disease infected *Homo sapiens* and *Pan troglodytes*. The said sequences were then imported into the multiple sequence alignment tool Clustal Omega to perform an all-round comparison between the four sequences and derive the interpretation from the achieved results.

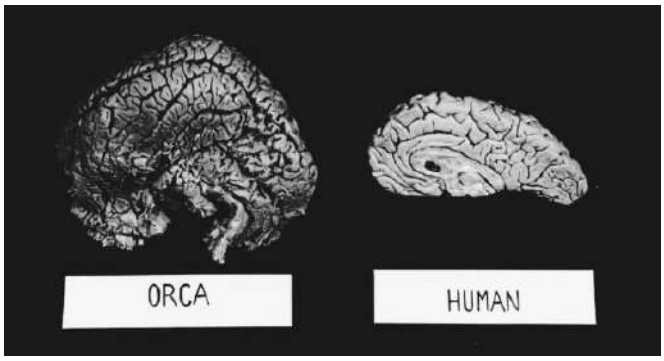
The prime aim of the study was to try and recognize the specific sequence responsible for the partial resistance to malaria in people affected by sickle cell disease. The disease is also seen in a few primates, like Chimpanzees (*Pan troglodytes*) so another rationale of the study was to compare the genes responsible for sickle cell disease in *Homo sapiens* and *Pan troglodytes* and also the wild type with the infected ones. Initially, the literature review was carried out just considering the comparison between wild type *Homo sapiens* and affected ones. It's possible that this will prevent infection or growth. Only one parasite is somewhat inhibited. The decrease in disease severity observed in SA and SS cells could be due to SA and SS cell function. the carrier of the sickle cell gene.

The r334 mutation is the one causing the sickling of cells in *Homo sapiens*. This mutation has an impact on the O2 concentrations which is a major mechanism of protection against severe malaria in individuals with sickle cell disease. A point mutation in the beta- globin chain causes sickle hemoglobin. At codon 6 of the beta hemoglobin chain, this point mutation swaps Adenine with Thymine leading to the amino acid glutamic acid to change to Valine. SNPs are found to be shared between the sequences of humans and chimpanzees 1.3-fold more often than is expected by chance which explains the similar mutation in both the species accounting for mutation into the sickle cell allele and giving rise to the partial resistance to malaria. Future prospects see these findings possibly being used pharmaceutically.

PRANALI DONGRE

STUDY OF NEUROANATOMY IN *Orcinus orca* DETERMINING INTELLIGENCE; USING BIOINFORMATICS

The killer whale's (*Orcinus orca*) brain possesses a wide range of cognitive and sensorimotor abilities. Although this is true, the scope of research into the Orcinus orca brain has been limited, resulting in significant gaps in our understanding of the animal's brain structure and function. The current research aims to describe the neural organization and potential function of the *Orcinus orca* brain while also establishing a link between these characteristics and potential evolutionary drivers.



From the study, cortical thickness has been observed as one of the reliable reasons for the cognitive abilities. Gyrification is another indicator of brain structure. It is a measure of the number of wrinkles and folds in the cortex. Gyrification enhances the amount of cortical nerve tissue that processes information, making brains with more wrinkles and folds more able to deal with and process more information more effectively. In cortical folds, neural impulses can be transmitted more quickly and with less energy since the cells are closer to each other. Orcas have the most glorified brain in the world. The highly developed telencephalon, which has a significantly greater level of encephalization than that seen in any other nonhuman animals, is one of the most defining features of cetacean brains. Two lines of evidence are investigated in this study to evaluate the assumption that a cetacean's large, well-developed brain is a direct outcome of the animal's adaptation to a totally aquatic lifestyle. The data from paleontology, on the other hand, contradicts this viewpoint. It shows that cetacean brain expansion happened millions of years after the time of adaptation to a completely aquatic existence ended. No compelling evidence was gathered to support this concept.

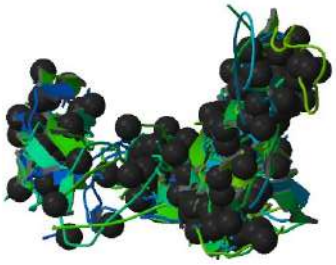
The aim of the study is to discern the evolutionary reason for the development of structures in the brain which makes orcas one of the highest ranked intelligent species. Magnetic Resonance Images of Orca's brain were quantitatively analyzed using BrainSuite, ROI delineation and 3D reconstruction. BrainSuite is a collection of open-source software tools that enable largely automated processing of magnetic resonance images (MRI) of the human brain. ROI delineation is a feature used to mark regions of interest in the brain.

Future quantitative research evaluating *Orcinus orca* specimens of varied sexes, ontogenetic stages, and ecotypes will be necessary to strengthen confidence in the present findings and conclusions, given the study's acknowledged limitations and limited sample size. Extensive research needs to be done in order to scrutinize the exact reasons for the high order intelligence in *Orcinus orca.*

KAINAT KHAN

COMPARING COLLAGEN TYPE 1 ALPHA 1 PROTEIN BETWEEN *T. rex* AND PIGEON

Evolution is the change in living organisms over time to survive. The origin of birds is one of the best-understood major transitions in the history of life. The evidence that birds evolved from dinosaurs is based on detailed studies of fossils, as well as the biology of modern birds. The evolution of birds began in the Jurassic Period and they evolved from a group of dinosaurs called theropods. The ancient birds looked quite a lot like small, feathered dinosaurs with several common features. Their mouths contained sharp teeth, but over time, birds lost their teeth and developed beaks.



Here we are comparing the Collagen type 1 alpha1 protein of *Tyrannosaurus rex* with *Columba livia* (Pigeon) for a better understanding of evolution between birds and dinosaurs. From the NCBI website, *T.rex* and Pigeon's FASTA format protein sequences were taken and blasted in BLAST (Basic Local Alignment Search Tool).

The significance of *Archaeopteryx* research is that it sheds some light on the evolution of birds from reptiles which plays an important role as a connecting link between them.

Collagen is an abundant structural protein in all animals. It is mostly found in connective tissue such as cartilage, bones, tendons, ligaments and skin.

This has been discovered in the soft tissue of the fossilized bones of a 68 million-year-old *Tyrannosaurus rex* fossil. This is by far the oldest protein detected to date. The humble pigeon is a descendant of the group of dinosaurs that also includes the mighty *T.rex*.

Some facts about the many bird-like characteristics of dinosaurs:-

- They were feathered
- Their joints were similar
- Had hollow bones and wishbones
- They had similar claws

Birds share so many features with dinosaurs and inherit bipedalism from them only.

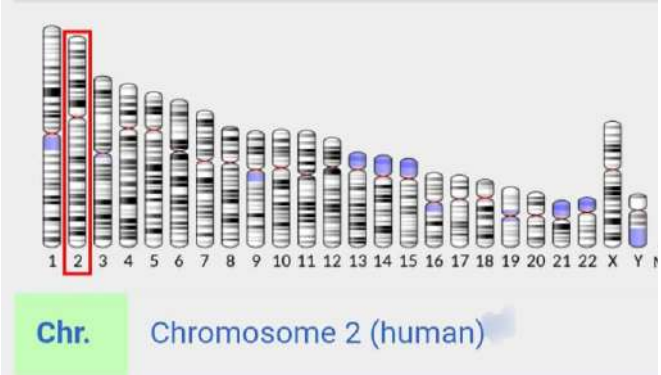
There are high number of identities, high number of positives and minimum number of gaps as well as lower number of expected value. Hence, it considered as a good match and gives us an information that birds have a dinosaurian ancestry.

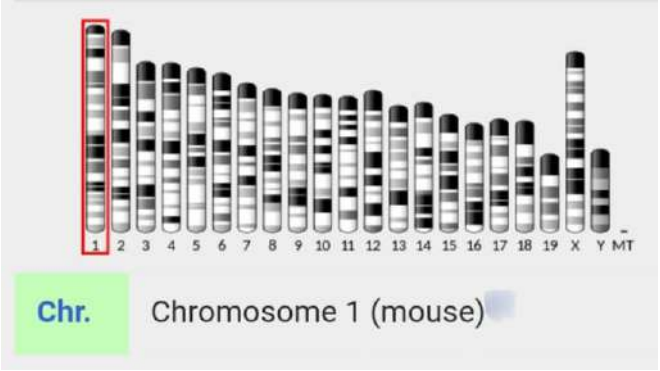
Here, we conclude that *Tyrannosaurus rex* and *Columba livia* have some similarities and they are related to each other by using bioinformatic tools (NCBI & BLAST) which give us some idea that birds evolved from dinosaurs. Hence, birds are considered avian dinosaurs.

SUNDARI KUMARI

MULTIPLE ALIGNMENT OF AAMP GENE IN HUMAN, MOUSE AND HORSE

AAMP (Angio Associated Migratory Cell Protein) is a protein-coding gene. The gene is a member of the immunoglobulin superfamily. The encoded protein is associated with angiogenesisawith potential roles in endothelial tube formation and the migration of endothelial cells.



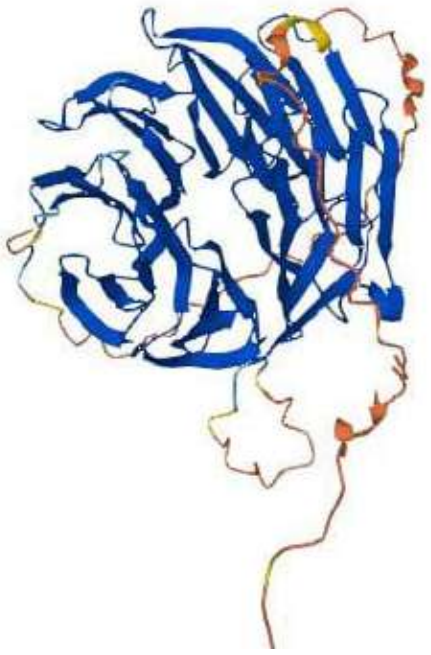


Using the SWISS-PROT for protein sequences database.
I have taken protein sequences for the following organisms:

1. *Homo sapiens*
2. *Mus musculus*
3. *Equus caballus*

Using Clustal Omega for multiple alignments.
I have selected the above sequence of AAMP protein and run it through the Clustal Omega software.

The AAMP protein contains two immunoglobulin-like Domains, the WD40 repeat motif, and a heparin-binding consensus sequence. The WD40 repeat motif is found in beta transducin. The AAMP derived peptide, P189, consists of a heparin-binding domain and mediates heparin sensitive cell adhesion.
That AAMP plays a role in Angiogenesis, one of the most important mechanisms of tumor development and metastasis, and is involved in transduction signal related to the cellular processes of adhesion, migration and proliferation. AAMP is found to be expressed in many tumor tissues and cell lines. AAMP's expression as an extracellular protein is more restricted and this form plays a role in blood vessel formation.

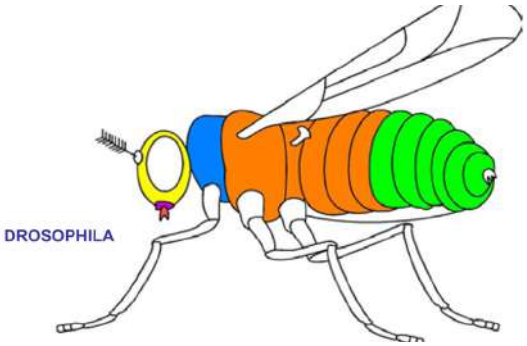


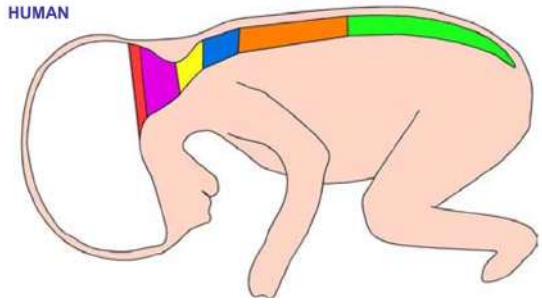
In the horse, the sequences differ by a single amino acid that is serine and in human and mouse at the place or serine, there is proline. It shows that the protein sequence is similar in all these 3 species. It indicates that the sequences are conserved during evolution and are almost similar in every species. According to its phylogenetic tree, the 3 species have the same most common ancestors.

PRATIKSHA SHARMA

COMPARATIVE STUDY OF HOX GENES IN HUMANS AND *Drosophila melanogaster*

DNA contains the code for the formation of different body parts. But however if proteins are expressed randomly, it would be difficult to differentiate all the parts. Initially, the human embryo is a cluster of cells, eventually an axis is formed which positions our head end and tail end. The HOX genes are responsible for this correct positioning of body parts in an organism





1. LAB gene with HOXA1.

```
# Length: 17613
# Identity:     1974/17613 (11.2%)
# Similarity:   1974/17613 (11.2%)
# Gaps:        15054/17613 (85.5%)
# Score: 2839.5
#
#
#=======================================
```

2. PB gene with HOXA2.

```
#
# Length: 34496
# Identity:     1688/34496 ( 4.9%)
# Similarity:   1688/34496 ( 4.9%)
# Gaps:        32398/34496 (93.9%)
# Score: 2271.0
#
#
#=================================
```

HOX genes are highly conserved and exist in a common ancestor of bilaterian animals. They are expressed in early embryonic development and exhibit spatial collinearity. When a HOX gene is expressed, it encodes for a specific HOX protein that acts as a transcription factor.

In the *Drosophila melanogaster*, the labial gene is necessary for development of embryonic, larval and adult heads. It is expressed in the mandibular lobe, hypopharyngeal organ, neural & epidermal cells of the procephalic organ. The Pb gene helps in the formation of mouthparts and labial maxillary palps.

In Humans, HOXA1 regulates the development of brainstem, inner-outer ear and hindbrain segmentation patterning. While HOXA2 controls the embryonic development of the lower-middle ear. In this paper, we studied the similarities of genes and proteins of organisms using bioinformatic tools.

Comparative analysis of genes using emboss needle tool (pairwise alignment). Comparative analysis of proteins using emboss sequence alignment.

Homeotic labial protein from drosophila is most similar to Isoform 3 protein from HOXA1 gene of humans.

On comparison we found out that these proteins are 28.2% similar in their positions of the amino acids.

PB gene forms 4 isoforms of protein i.e. A,B,C and D. But it is found out that C and D isoform proteins are most similar to HOXA2 protein both showing a similarity of 18%.

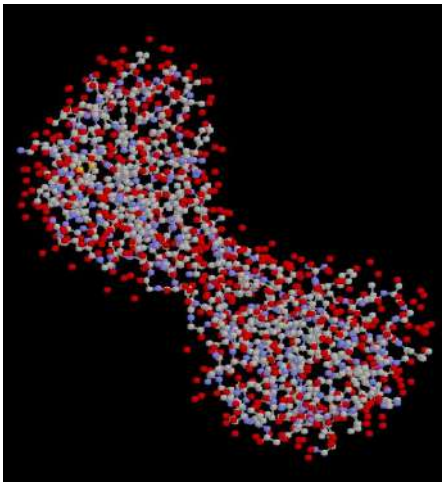
The HOX genes are early actors in a cascade of interactions that enable development of morphologically distinct regions in a segmented animal.

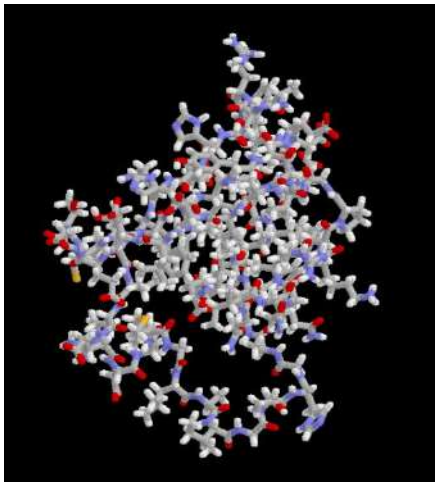
Indeed, the activation of the HOX gene from the 3' end is one of the earliest triggers that leads to the segmentation for the further development of the head. In this analysis, we can see that there is less than 30% similarity between the HOX genes which are homologous in function. Obviously, because the organisms are a lot different from each other.

RENUKA YADAV

ASD, ID AND ADHD : A COMPARATIVE STUDY USING BIOINFORMATIC TOOLS

Neurodevelopmental disorders (NDDs) are psychiatric diseases caused by anomalies in brain development induced by somatic or germline mutations. Schizophrenia, Autism Spectrum Disorder (ASD), ADHD, Intellectual Disability (ID), and mood disorders are all characterized by a variety of brain-based symptoms, some of which overlap between diagnostic categories.





ADHD, ASD, and ID are common co-occurring NDDs and are very frequent. ID is one of the most prevalent co-occurring diagnoses in people with ASD, with estimates ranging from 30 to 80% of children with ASD meeting ID criteria. ID is frequently diagnosed in conjunction with ASD, although it can also be found in people who have ADHD. In fact, those with ID are more likely to be diagnosed with ADHD, with prevalence rates of co-occurring ADHD and ID as high as 14% in comparison. The prevalence of co-occurring ASD and ADHD in children is estimated to be between 20% and 50%. There are various examples of symptoms that overlap between ADHD, ASD, and ID. Many studies have found that the symptoms of ASD, ID and ADHD are similar. According to teachers and parents, 60 percent of children with ASD were easily distracted, 50 percent had difficulties concentrating, and 42 percent to 44 percent had elevated activity levels and restlessness in a study assessing ADHD symptoms in children with ASD. Therefore, we can conclude that these three NDDs have comorbidity between them and their genetic cause has some connection.

The increase of the cysteine-guanine-guanine (CGG) triplet repeat within the Fragile X mental retardation one gene (FMR1) on the X chromosome causes FXS indirectly. This CGG expansion silences FMR1 expression, resulting in the fragile X mental retardation protein being completely or considerably reduced in expression (FMRP). FMRP is required for the formation of neural connections (synapses) and the function of specific ovarian organs.
In the case of DLG2 gene, It plays a critical role in the formation, plasticity, and stability of synapses as a scaffolding protein that binds to both cytoskeleton proteins and signaling complexes.

CGG repeats in the FMR1 gene which leads to Fragile X Syndrome (FXS) plays a role in the genetic aetiology of Autism Spectrum Disorder (ASD), Intellectual Disability (ID) and Attention Deficit Hyperactivity Disorder (ADHD).DLG2 plays a similar role in complicated cognitive and learning activities in mice and humans.
Therefore, human CNV deletions in DLG2 have been linked to various NDDs.
Studies showed consistent enrichment of HPin7 and HPin8 deletions in DLG2 gene leading to Neurodevelopmental Disorders. HPin7 peak in DLG2 intron 7, HPin8 peak in DLG2 intron 8, HP either HPin7 or HPin8, HPs both HPin7 and HPin8, CFE coding first exon, leading to NDD.

HIBAH MULLA

STATISTICAL ANALYSIS OF FACTORS INFLUENCING MENSTURAL IRREGULARITIES

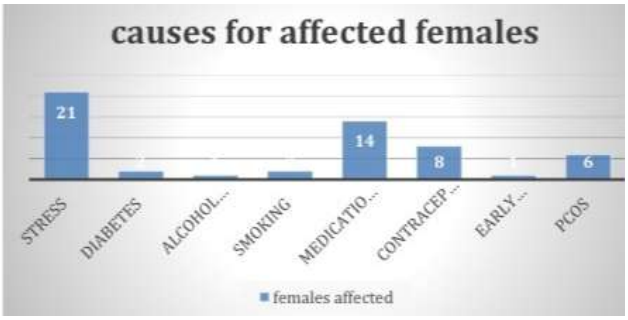
The menstrual cycle is defined as a series of events that occur in a woman's life. Menstruation lasts between 2 and 7 days and the menstrual cycle lasts 28 to 35 days. Menarche is the term for the first period of menstrual bleeding, which occurs around the age of 12 years.

According to several studies, women have a variety of anomalies throughout their menstrual cycle, including amenorrhea, hypomenorrhea, menorrhagia, and dysmenorrhea. Stress, diabetes, smoking and alcohol use, hormonal changes such as polycystic ovarian syndrome (PCOS), early menopause, contraceptive pills, and medical medicines are some of the causes of abnormalities in the menstrual cycle.

A cross-sectional investigation was carried out. A total of 120 females are polled. As a result, the sample space for this study is around 120. Females were asked to fill out a questionnaire on their menstrual cycles, as well as other criteria such as age and weight. Females from all sorts of backgrounds are encouraged to take part in the study.

Stress, peer pressure, and anxiety are the most significant factors in menstruation irregularity. Most females are also experiencing job or study-related stress, as a result of which they experience anxiety and despair. This results in hormonal imbalance, which leads to menstrual irregularities.

The most common menstrual irregularity is dysmenorrhea. The flow of blood is irregular in women who have monthly abnormalities. They either have little or a lot of blood loss. In addition, the number of days of menstrual flow is either fewer (2-3 days) or higher (6-8 days). However, the current study has several limitations; for example, it becomes a cross sectional study, which makes it restricted and unsuitable for many situations. Furthermore, there is a clear link between psychological stress, diabetes, and amenorrhea and dysmenorrhea



According to the study, the most likely cause is a poor lifestyle and the everyday stress that women suffer, as well as hormone imbalance. The value of better behavioral practices in maintaining menstrual cycle regularity is demonstrated in this study, especially when these factors are included.

MEGHA THAKUR

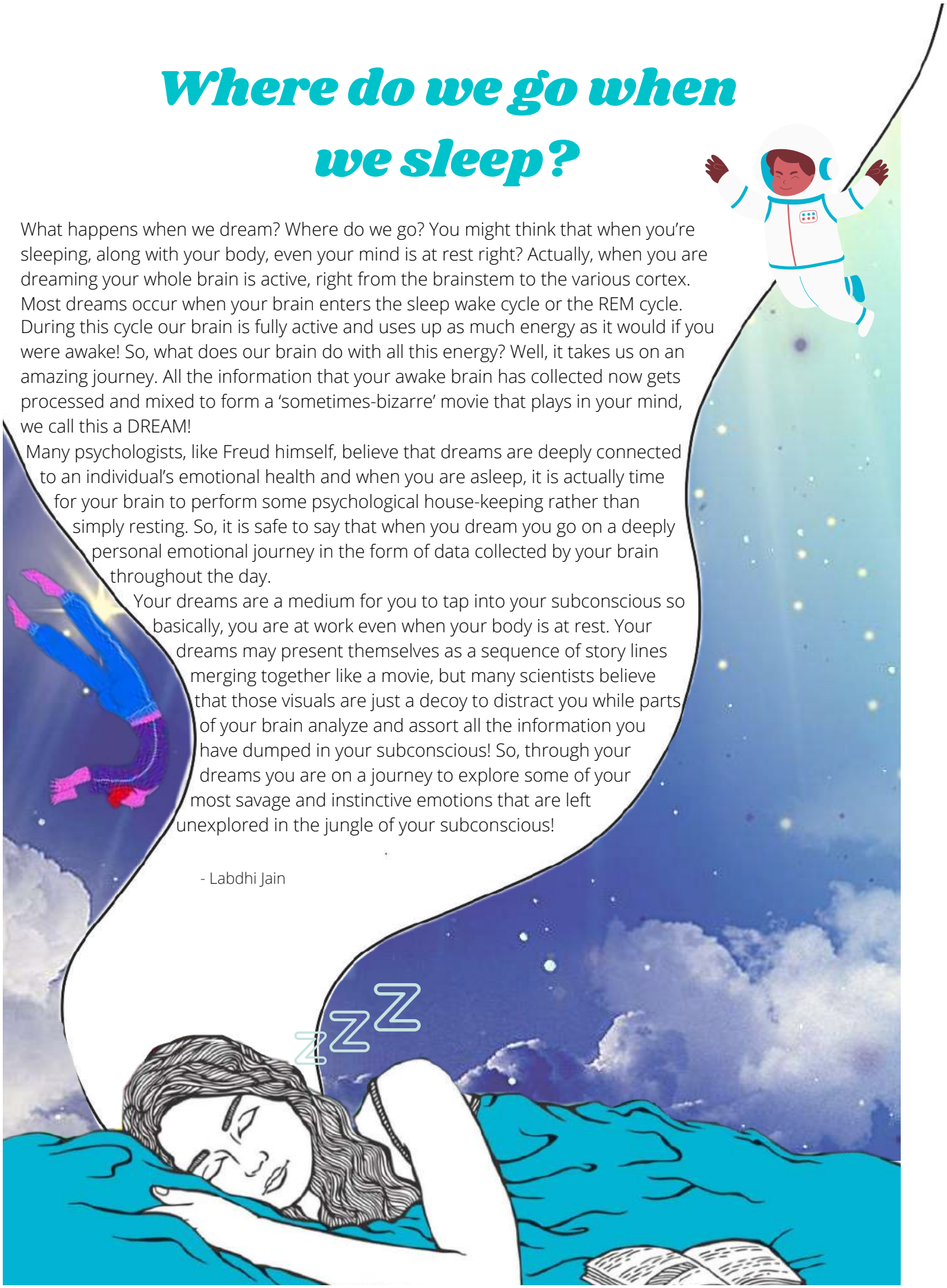
Where do we go when we sleep?

What happens when we dream? Where do we go? You might think that when you're sleeping, along with your body, even your mind is at rest right? Actually, when you are dreaming your whole brain is active, right from the brainstem to the various cortex. Most dreams occur when your brain enters the sleep wake cycle or the REM cycle. During this cycle our brain is fully active and uses up as much energy as it would if you were awake! So, what does our brain do with all this energy? Well, it takes us on an amazing journey. All the information that your awake brain has collected now gets processed and mixed to form a 'sometimes-bizarre' movie that plays in your mind, we call this a DREAM!

Many psychologists, like Freud himself, believe that dreams are deeply connected to an individual's emotional health and when you are asleep, it is actually time for your brain to perform some psychological house-keeping rather than simply resting. So, it is safe to say that when you dream you go on a deeply personal emotional journey in the form of data collected by your brain throughout the day.

Your dreams are a medium for you to tap into your subconscious so basically, you are at work even when your body is at rest. Your dreams may present themselves as a sequence of story lines merging together like a movie, but many scientists believe that those visuals are just a decoy to distract you while parts of your brain analyze and assort all the information you have dumped in your subconscious! So, through your dreams you are on a journey to explore some of your most savage and instinctive emotions that are left unexplored in the jungle of your subconscious!

- Labdhi Jain



WHY DO WE LAUGH ?

Humans begin laughing as early as three months of age, even before they can speak. This is true even for deaf or blind babies. Laughter and a sense of humor are essential components of adaptive social, emotional, and cognitive performance. Surprisingly, they are not exclusively human. Primates and apes both enjoy a good laugh. This could have evolved as a means of survival. After all, laughter is a social activity that promotes bonding, diffuses potential conflict, and relieves stress and anxiety.

Laughter begins with the activation of the ventromedial prefrontal cortex, which produces endorphins to reduce pain. The limbic system, which lies just beneath the cerebral cortex, controls many functions associated with mood, friendships, love and also seems to be central to the production of laughter. Once a joke is understood as funny, the motor aspects of laughter initiate. This may include the contraction of facial muscles, and in extreme circumstances, the activation of tear ducts. Additionally, the epiglottis half-closes the larynx, so that air intake occurs irregularly, which explains why people may gasp while laughing. If, however, someone seems to be laughing uncontrollably or at inappropriate times or in a way that is disruptive to their life, they may be having a condition called pseudobulbar effect. This condition is usually the result of a neurological condition or injury.

Laughter has been demonstrated to reduce the amount of stress chemicals in the body, including serum cortisol, epinephrine and catecholamines. These are responsible for elevated blood pressure and platelet levels, which can lead to artery blockages. It also raises the number of natural killer cells and T-cells, both of which are essential components of the immune system, as well as B-cells, which produce antibodies to fight disease. Laughter also works out the muscles of the diaphragm, abdomen, respiratory tract and the back. Researchers estimate that laughing 100 times is equivalent to ten minutes on a rowing machine or 15 minutes on an exercise bike. Laughing lowers total blood pressure and increases vascular blood flow and oxygenation of the blood.

- Odelia Rebello


Evolution

RELATION BETWEEN BEHAVIOUR PATTERNS OF CETACEANS AND THEIR BRAIN SIZE EVOLUTION

Cetaceans are aquatic predatory mammals having invaded nearly every marine habitat on the planet. There are 88 species of cetaceans, ocean dolphins, porpoises, sperm whales, beaked whales, river dolphins and many others. We know little about their social organisation, questions like HOW and WHY are often asked in that aspect. The focus of this research will be on the evolutionary advancements of their brain size.

This study will also be an eye-opener to the years of progress in behavioural patterns of Cetacean which went unnoticed.

After some Literature review, it was found that the cetacean ASPM gene (abnormal spindle-like microcephaly associated protein) was identified as a primary determinant of cerebral cortical size in mammals. To speculate multiple theories from this research, the ASPM gene of representative Cetacean species such as *Tursiops truncatus* (Bottlenose Dolphin) and *Lipotes vexillifer* (Yangtze River Dolphin), were compared to similar sequences from mammals such as *Homo sapiens* (humans) and primate species *Bos taurus* (cattle). This had been carried out with the help of Bioinformatics tools like Clustal Omega, Multiple Alignment tool and MUSCLE – Multiple Sequence alignment tool another extension of Clustal Omega by the same company.

The “walk back” into the ocean for mammals claims its probability to be higher after this research.

*Lipotes vexillife*r being one of the older Cetacean families displayed the most similarities with its primate partner *Bos taurus* nearly followed by *Homo sapiens*. Unexpected linkages between brain size evolution and the social evolution hypothesis of cetaceans will present us with a plethora of new and advanced theories.

The final output gathered from all the results is that the ASPM gene sequence between *Lipotes vexillifer* and *Bos taurus* had the maximum percentage identity (76.22%). Therefore, 76.22% of their amino acid sequences are identical. Likewise, the least percentage identity was observed between *Tursiops truncatus* and *Homo sapiens* (12.52%). Therefore, only 12.52% of both their amino acid sequences are identical. Similar patterns of results were observed with other alignments. It appears that both primates and cetaceans have inherited enlarged brains by alterations in the same gene

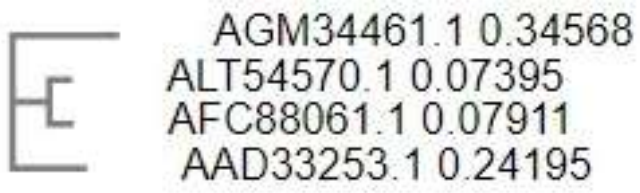
So this indicates that *Lipotes vexillifer* was highly influenced by *Bos taurus* back in time, be it from the social behaviour perspective, which ultimately lead to their similarities in the ASPM gene, eventually in their brain size evolution.

PRERANA KAMAT

EVOLUTION OF E6,E7,L1,L2 GENES OF HUMAN PAPILLOMAVIRUS

The papillomavirus are among the oldest existing viruses. During evolution, *Human Papillomavirus* (HPV) developed and acquired the capacity to utilize human cellular proteins for replication, silently hijacking the Cellular and Immune System.

This research was carried out to understand the evolution that took place in HPV over generations.
For this research four variants of HPV, namely type-6, 11, 16, 18 were used as these variants are commonly occurring variants. The early genes of HPV that encodes E6 and E7 proteins were used, as these interfere with the normal cell cycle of the cell and targets the Rb tumor suppressor protein and p53, also provides oncogenic potential to the virus. The late genes encode for two capsid proteins L1 and L2 , as these proteins are required for transmission, survival and spread of the virus. The NCBI database was used to retrieve protein sequences of all four variants. Multiple sequence alignment tools were used, that is Clustal Omega, to align the sequences and construct the phylogenetic tree.
All viruses evolve over time and studying virus evolution is crucial to understand the evolutionary pattern and virus action, also the vaccines currently in use can be modified accordingly.




```
AGM34461.1      MYGPKATLQDIVLHLEPQNEIPVDLLCHEQLSDSEEE-NDEIDGVNHQHLPARRAEPQRH   59
ALT54570.1      MHGRHVTLKDIVLDLQPP--DPVGLHCYEQLVDSSEDEVDEVDG--QDSQPLK----QHF   52
AFC88061.1      MHGRLVTLKDIVLDLQPP--DPVGLHCYEQLEDSSEDEVDKVDK--QDSQPLT----QHY   52
AAD33253.1      MHGDTPTLHEYMLDLQPE---TTDLYCYEQLNDSSEEED-EIDGPAGQAEPDR----AHY   52
                *:*   **:: :*.*:*     ..* *:*** **.*:   ::*    :  *       :.

AGM34461.1      TMLCMCCKCEARIELVVESSADDLRAFQQLFLSTLSFVCPWCASQQ  105
ALT54570.1      QIVTCCCGCDSNVRLVVQCTETDIREVQQLLLGTLDIVCPICAPKT  98
AFC88061.1      QILTCCCGCDSNVRLVVECTDGDIRQLQDLLLGTLNIVCPICAPKP  98
AAD33253.1      NIVTFCCKCDSTLRLCVQSTHVDIRTLEDLLMGTLGIVCPICSQKP  98
                 ::  ** *:: :.* *:.:  *:* .::*::.**.:*** *: :
```

In the protein sequence alignment obtained from clustal omega the "-" represents the "gaps", it means that due to some evolutionary events, there is a deletion of these amino acids. The "*" indicates that amino acids are 100% conserved, "." indicates conservation between amino acid groups of weekly similar properties and ":" indicates conservation between groups of strongly similar properties. As seen in the alignment result of the E7 protein sequence of HPV type-6, 11, 16 and 18 did showed gaps that is deletion of amino acids, and 100% conservation of some groups of amino acids, it also showed conservation between amino acids groups of weekly similar properties and strongly similar properties. Hence our result shows that evolution of HPV virus did take place over generations.

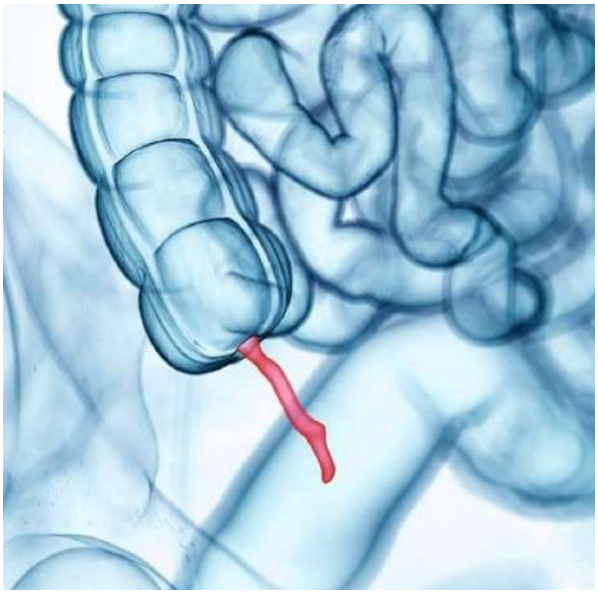
The phylogenetic tree shows that type 6 and 11 are closely related, as they belong to the same clad and have evolved from same ancestor, hpv type-16 and 18 are closely related because they have same clad and these two show distinct relation with type, 6 and 11, but indicating that they all have evolved from common ancestor. The results of other protein sequences used in the study showed similar results.

FATIMA ZEHRA

COMPARATIVE STUDY ON THE EVOLUTION OF APPENDIX OF HUMAN AND RABBIT

This study aims to compare the Vermiform Appendix of humans and rabbits based on its morphological and functional aspects, by comparing the CD5 gene.

This is because of its histomorphology, development and function, but again, the removal of the Appendix doesn't cause any harm to humans afterwards. The term vermiform comes from the Latin word vermis which means worm-like. Organs that have no apparent function and are considered to be residual parts of ancestors are called vestigial organs and the appendix is considered a vestigial organ.



In this paper, the similarities between both the human and Rabbits appendix were tried to be studied. First, the morphological and functional similarities were studied and then the similarities of the CD5 gene were studied by obtaining the protein sequences of the gene from both the organisms through a protein database and then they were blasted using pairwise alignment tools. The appendix of humans and rabbits showed morphological and functional similarities, but even though the human appendix had shown the presence of B-cells and also in the regulation of gut flora, it is still difficult to trace its exact function also its removal doesn't bring any significant change in the body is still questioned. But through this paper, we were able to show CD5 gene similarities which can be further used in immunology studies. It was concluded that both appendixes have a common evolutionary ancestor. The appendix of rabbits shows various functions related to immunology and also the higher presence of CD5, this can be used in further studies or work in the production of drugs. Diseases associated with CD5 include Thymic Carcinoma and Richter's Syndrome. So, as this gene shows common evolutionary factors, this can be used for further study in immunology and to find out a cure for this disease.

unnamed protein product

Sequence ID: **Query_50059** Length: **172** Number of Matches: **1**

Range 1: 4 to 137 Graphics ▼ Next Match ▲ Prev

Score	Expect	Method	Identities	Positives	Gaps
144 bits(364)	2e-49	Compositional matrix adjust.	76/136(56%)	95/136(69%)	3/136(2%)

```
Query  5    NMPMGSLQP-LATLYLLGMLVASCLGRLSWYDPDFQARLTRSNSKCQGQLEVYLKDGWHM  63
            ++ MGS  P LA + LLGMLV SCLG  SW +P F A LT S+S CQGQLEVY    WH
Sbjct  4    BITMGSQPPPLAAVSLLGMLVTSCLGWSSWDEPGFLANLTNSHSPCQGQLEVYTTGSWHT  63

Query  64   VCSQSWGRSSKQWEDPSQASKVCQRLNCGVPLSLGPFLVTYTPQSSIICYGQLGSFSNCS  123
            VCS+SWG +S+ W+DP +ASK+CQ+L+CG  L++GPF     P++ + C G  GSF+NC
Sbjct  64   VCSRSWGMNSEGWKDPWKASKLCQQLHCGEALAVGPFPHFNKPRNQLFCMGLPGSFANC-  122

Query  124  HSRNDMCHSLGLTCLE  139
              SR   CHSLGL CLE
Sbjct  123  -SRISQCHSLGLVCLE  137
```

The result showed that both the sequences show similarities. From the database, protein sequences were taken and then blasted. This helped us to understand that the genes have evolutionary similarities in them and also the appendix of both organisms shows similarities in many ways, i.e., in morphological and functional ways.

DRISHYA NAIR

A WORLD WITHOUT SCURVY: RESEARCH ON THE VITAMIN C PSEUDOGENE

Many people realised the importance of Vitamins during the Coronavirus pandemic. We know that deficiency of Vitamins can cause illnesses. The deficiency of Vitamin C or 'ascorbic acid' causes scurvy. Hence, we must consume such vitamins in ideal amounts. But have you ever noticed your pet dog? It doesn't worry about eating vitamin supplements as it can produce Vitamin C from Glucose in its body. While other mammals like humans, bats, guinea pigs, etc. have lost this ability.

Our ancestors could synthesize Vitamin C through a biochemical pathway. The genes that code for the enzymes of this pathway are found in all of us till date. Yet, we cannot synthesize Vitamin C. This is because the gene (GULO) that is responsible for the last reaction of this pathway was mutated largely over time and became an inactive pseudogene. Although the other genes of this pathway remain active.

This research project is a comparative study of RGN gene, Slc23a2 gene and mutated GULO gene involved in Vitamin C biosynthesis pathway, in *Homo sapiens* (Humans) with other mammals like *Sus scrofa* (Pig), *Hipposideros armiger* (Bat), *Bos taurus* (Cattle); over evolution using Bioinformatics tools. The tools used were GenBank from NCBI to retrieve gene sequences and BLASTN to align them in a pairwise manner.

According to literature, pigs and cattle can synthesize Vitamin C while Humans and Bats cannot. Hence we were able to predict results that:

Not all bats have lost the ability to synthesize Vitamin C. Thus they are currently on their way to pseudogenization. Hence evolutionary study of bat GULO genes can be an excellent model to study genetic processes in relation with loss-of-function.

Studying the gene could help create drugs for the synthesis of Vitamin C in patients suffering from Scurvy.

Analysis of gene sequences of various species of the Haplorhini and Strepsirrhini suborder if obtained could help us trace back where the mutations occurred in our lineage. Giving us a better understanding about why and how we have a mutated GULO gene, while the other genes of the same pathway still remain active. It would also help find if the GULO gene plays any silent role we are unaware of.

- Humans and bats would have similar GULO genes
- Pigs and cattles would have similar GULO genes
- While humans, bats, pigs and cattle could have similar RGN and Slc23a2 genes in varying ranges as these genes are still active in all the mammals and the genes are involved in other pathways as well.

1. GULO Gene

Organism	E value	Percentage Identity	Gaps	No of matches
Pig	2e-26	86.54%	0%	2
Cattle	2e-26	86.54%	0%	1
Bat	1e-26	87.25%	0%	1

2. RGN Gene

Organism	E value	Percentage Identity	Gaps	No of matches
Pig	3e-104	85.84%	0%	4
Cattle	1e-107	85.48%	1%	6
Bat	6e-157	83.75%	3%	4

3. Slc23a2 Gene

Organism	E value	Percentage Identity	Gaps	No of matches
Pig	0.0	76.14%	8%	14
Cattle	0.0	80.15%	5%	14
Bat	0.0	81.24%	6%	16

On pairwise alignment of human sequences with other mammals, the results were seen to be as predicted above.

MUDITA ADANIYA

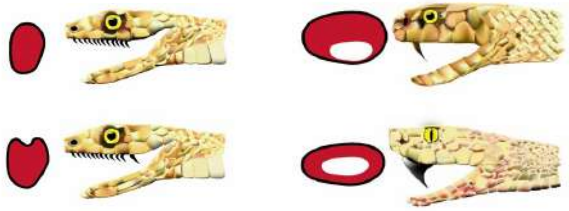
EVOLUTION OF OCCURRENCE OF FANGS IN VENOMOUS AND NON-VENOMOUS SNAKES WITH RESPECT TO VENOM DELIVERY SYSTEM.

Among some of the well-known predators with a unique defense system, are snakes. Some features which make them well-known predators are their morphological modifications like loss of limbs, development of venom delivery system and many more. Fangs of the snake are one of the most elegantly modified teeth in vertebrates.They are modified maxillary teeth revolutionized especially for the venom delivery system. One of the significant bifurcations seen among subclass Serpentes, is the classification of snakes into venomous groups and non-venomous groups. From this classification arises the question- "what led to such classifications and what is the difference between the two groups of snakes."

This study was mainly accumulated through literature review. In this study, four families of snakes with different types of modification of venom glands were considered, namely - *Boidae, Colubridae, Elapidae* and *Viperidae*. Based on which, their order of evolution was traced.

Literature revealed that the following four types of fangs are present based upon the modification of venom delivery system in Serpentes:

1. Solenoglyphous fangs- They are long, tubular, hinged fangs with well developed venom glands. The *Viperidae* family is known for such fangs.
2. Proteroglyphous fangs- They are fixed and comparatively shorter fangs with developed venom glands.The *Elapidae* family is known to possess such fangs.
3. Opisthoglyphous fangs- They are rear, short fanged snakes with incompletely developed venom glands. The *Colubridae* family is known to possess those kinds of fangs.
4. Aglyphous fangs- In these fangs are absent, there is failure in development of venom glands. Venom glands are present in vestigial form called Duvernoy's gland. The *Boidae* family possesses such fangs.



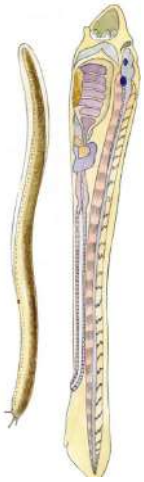
The aim of this study is to know about the genetic relationship between venomous and non-venomous snakes based on their development and positioning of fangs. It also focuses on studying the reason behind diversification of snakes into venomous and non-venomous categories

It has been seen that the snakes, when evolved from lizards, had no fangs but only a certain amount of toxin proteins in their salivary glands. This helps us predict that venomous snakes evolved from non-venomous snakes and the evolution of the four families would have been in the order: *Boidae* family with completely ossified teeth. *Colubridae* family with slightly grooved fangs. *Elapidae* family with partially tubular fangs. *Viperidae* family with completely tubular fangs.

VIPRA PAREKH

EVOLUTION OF ADAPTIVE IMMUNITY IN JAWLESS VERTEBRATES USING BIOINFORMATIC TOOLS.

The evolution of complex immune systems emerged because of the struggle for survival and the need for self-defence. Some biologists found that bacteria, single-cell eukaryotes, and archaea even have a complex immune defence. The earlier strategies that were used for defence against the pathogens were called innate immunity and another complexity layer in immune defence that was composed of specialised cells and processes that killed the pathogens was called acquired or adaptive immunity.



Adaptive immunity has been associated with the evolutionary emergence of vertebrates like hagfish and lampreys. And this is characterised by many repertoires of somatically assembled antigen receptors and the antigen-specific memory and it leads to more efficient secondary immune responses. They were first shown to have antibody-like immune responses but recent studies have suggested that the lampreys have lymphocytes that express leucine-rich repeat-containing antigen receptors commonly known VRLs. In order to compare the structures of hagfish VLRA, hagfish VLRB, lamprey VLRA and lamprey VLRB were taken from the Protein Data Bank. The loop that is present in the LRRCT portion is in red colour. From the comparison.

We understand that the hagfish 3rd VLR, lamprey VLRA, hagfish VLRB and lamprey VLRB have a protruding loop. However, the hagfish VLRA and lamprey VLRC do not have the loop. The major importance of the loop is that it helps in antigen recognition. But the hagfish VLRA and lamprey VLRC are shorter in length and thus cannot form the loop.

Therefore, this structure predicts that hagfish 3rd VLR has a solenoid structure like others and it has around 10 residues similar to lamprey VLRA. When this peptide sequence was blasted in NCBI it had the highest similarity. All the VLRs that have four cysteines and form disulphide bridges are in LRRCT. Here the four cysteines in LRRCT of hagfish 3rd VLR match with the lamprey VLRA.

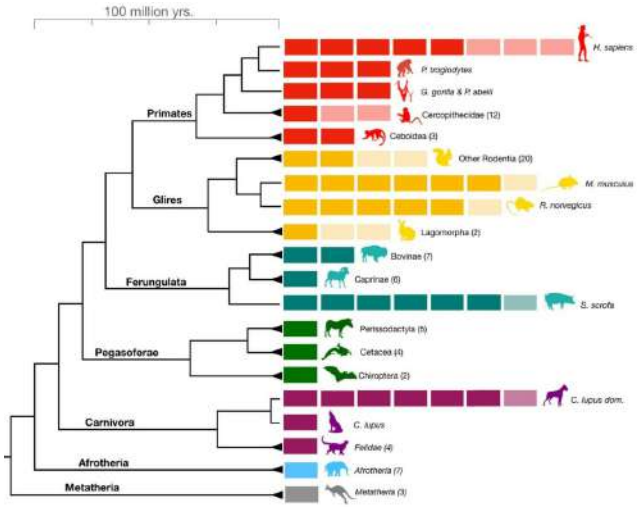
The discovery of VLR-type antigen receptors in lampreys and 3rd VLR in hagfish have given us an unprecedented insight into the origin of adaptive immunity at the early stages of vertebrate evolution. The molecular details of antigen receptor structure and their modes of somatic diversification between lampreys and hagfish vertebrates has shown some similarity in the VLR genes, the dichotomy of functionally distinct yet interactive lymphocyte lineages are conserved and hence it appears to be an ancestral feature of the vertebrates. Given these striking similarities in design, the immune system of jawless vertebrates will guide future studies of agnathan adaptive immunity.

TANUSHREE PATIL

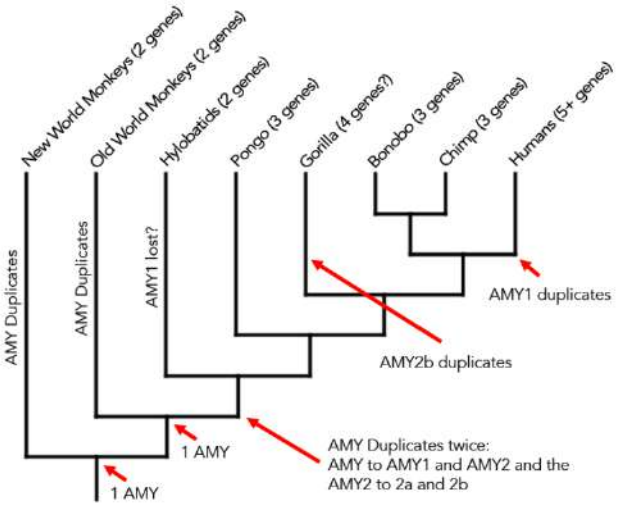
MIGRATION EFFECTS ON AMY1 GENE BETWEEN CHIMPANZEE AND HUMANS

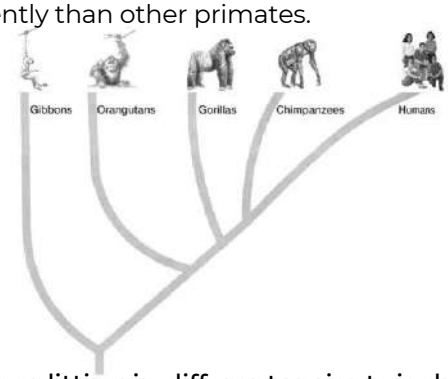
Do you know that chimpanzees and humans are the most closely related apes till date? There are evolutionary changes in them, but they share 98.6% of similarities in their DNA.This is due to the characteristic changes caused by genetic drift and diversion of species. This study covers how migration affected human and chimpanzee diversion through AMY1 gene

The AMY1 gene is responsible for salivary amylase secretion. The gene has many subunits like AMY1A, AMY1B, AMY1C. The copies of this gene changes in several species according to a diet rich in starch. We find that Humans have all the copies of AMY1 gene but chimpanzees have only AMY1C. This change in copies of AMY1 gene is due to the availability of food due to migration. Compared to other great apes and chimpanzees, the AMY1 locus is significantly expanded in humans with a higher number of variations. Chimpanzees and humans evolved from the same ancestor. This evolution of AMY1 gene in different numbers is due to the number of consecutive events involving inter and intra chromosomal crossovers. This was since they started diverging in different areas containing different habitats



The situation was such that some of the population was getting starchy food materials leading to an increase in AMY 1 copies. The division of population by geographic barriers played a role in evolutionary adaptation and separation of apes species. Later it was discovered that even though chimpanzees and humans were closely related, the old world monkeys like baboons had greater amylase production even though they possessed fewer copies of AMY1 gene. Further research is necessary to know whether humans and other apes are more prominent in processing starch efficiently than other primates.





At last we find that the differences in AMY1 gene and its splitting in different variants is due to consumption of starch. Also from the nucleotide and protein sequences compared, we can conclude there are very minute differences in both chimpanzees' and humans' AMY1C gene. Here, migration plays the main factor, as availability of starch is according to habitat and changes in surrounding. As apes started separating and getting acquired to new environments, the necessity of genes increased leading to duplication. The presence of AMY1 gene in both the organisms with very few mismatches when compared with sequence alignment and their E value proves that they are closely related and that they may have diverged into new species due to migration to different areas, giving different numbers of AMY1 gene copies.

TANAYA SALVI

COMPARISON OF FOXP2 AND CNTNAP2 GENES, PROTEINS IN HUMANS, CHIMPANZEES, MOUSE

The FOXP2 and CNTNAP2 are the protein-encoding genes that are involved in Speech and Development and are present in all animals and humans.

The mutations in these genes cause several neurodevelopmental disorders, including Gilles de la Tourette syndrome, schizophrenia, epilepsy, autism, ADHD and intellectual disability. The main goal of this research is to find the similarities, differences, 3D structures and phylogeny of these three organisms using Bioinformatic Tools.

Studying this research will give a better understanding of these FOXP2 and CNTNAP2 genes and proteins, as much research is not available related to it.

The genes and the protein sequences were retrieved from sites such as NCBI and the SwissProt software. The Bioinformatics Tools which are used for comparing these FOXP2 and CNTNAP2 genes and proteins are BLASTN, BLASTP, Rasmol software and Clustal Omega for finding the Pairwise Alignment and Multiple Alignment of these genes and the proteins sequences and to study their similarities, differences, 3D structures and phylogeny.

❖ PDB STRUCTURES OF FOXP2 PROTEIN-

HUMANS CHIMPANZEES MOUSE

❖ PDB STRUCTURES OF CNTNAP2 PROTEIN-

HUMANS CHIMPANZEES MOUSE

A) PAIRWISE ALIGNMENT -

1. FOXP2 GENES – Mostly related – Humans and Chimps. Distinctly related – Chimps and Mouse
2. CNTNAP2 GENES – Mostly related – Humans and Chimps. Distinctly related – Chimps and Mouse
3. FOXP2 PROTEINS – Mostly related – Humans and Chimps. Distinctly related – Chimps and Mouse
4. CNTNAP2 PROTEINS – Mostly related – Humans and Chimps Distinctly related – Chimps and Mouse.

B) 3-D STRUCTURES OF PROTEINS -

1. FOXP2 – The structures of all three organisms were different from each other irrespective of the fact that 99% similarity was found among Human and Chimpanzees protein sequences.
2. CNTNAP2 - The structures of all 3 organisms were different from each other irrespective of the fact that 99.55% similarity was found between Human and Chimpanzee Protein sequences.

C) PHYLOGRAM -

1. FOXP2 – The common ancestor between Humans and Chimps is observed and the Mouse has been the outgroup.
2. CNTNAP2 - The common ancestor between Humans and Chimps is observed and the Mouse has been the outgroup.

Hence, with the help of the above results from this research it can be concluded that Humans and Chimpanzees are mostly related and the Chimps and Mouse and Humans and Mouse are most distinctly related for this FOXP2 and CNTNAP2 Genes and Proteins.

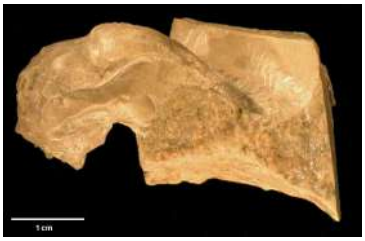
NEHA THORAT

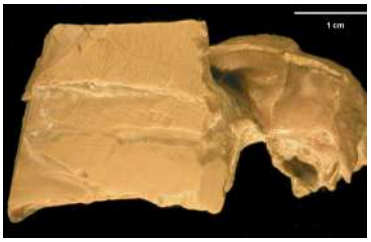
COMPARING AVIAN FEATURES OF *Archaeopteryx lithographica* WITH MODERN DAY BIRDS

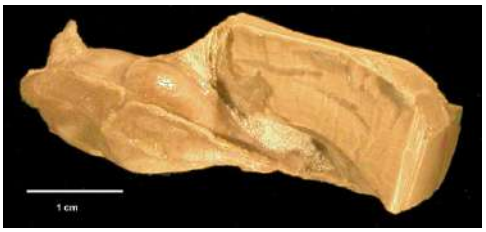
The study of fossils has greatly aided in the understanding of dinosaur evolution and its various species. Fossils are mostly found in sedimentary rocks, which are formed by a sequence of marine, lake, and desert deposits.

Archaeopteryx fossils were discovered in upper Jurassic limestone strata in Bavaria. It demonstrated parallels in features between reptiles and birds. Paleontologists focused on the avian traits and discovered feathers and beaks. This prompted a more thorough investigation, and questions arose as a result.

Ground-dwelling organisms with basic feathers that formed planning surfaces allowing them to increase their running speed evolved into birds, according to the cursorial hypothesis. Virtual paleontology is a subject in which researchers can use digital technologies to analyze fossils. The photos of CT scans of *Archaeopteryx's* skull were retrieved from the Digital Morphology website, which is part of the National Science Foundation's Digital Libraries Initiative, creates and distributes unique 2D and 3D renderings of the internal and external structures of current and extinct vertebrates.







Archaeopteryx's post cranial skeleton implies that the bird's skull has a few avian characteristics. In contrast to the mostly reptile post cranial skeleton, *Archaeopteryx*'s skull has a few distinctly avian features. The palatine has a maxillary (premaxillary) process, a hook shaped choanal process, and a long pterygoid wing, making it distinctly avian. The coronoid bone is missing from the mandible. *Archaeopteryx* has asymmetric contour feathers in the wing and on the side of the tails. As a result, *Archaeopteryx* was almost certainly capable of flight, though it's difficult to say whether it was a flapper or a glider. The presence of melanin in the feathers indicated that they were black, and the arrangement of granules in the feather indicated that it provided structural support for the wings. This evidence indicates that *Archaeopteryx* is half- bird, half-reptile, and hence the 'missing link' or 'connecting connection' between dinosaurs and birds.

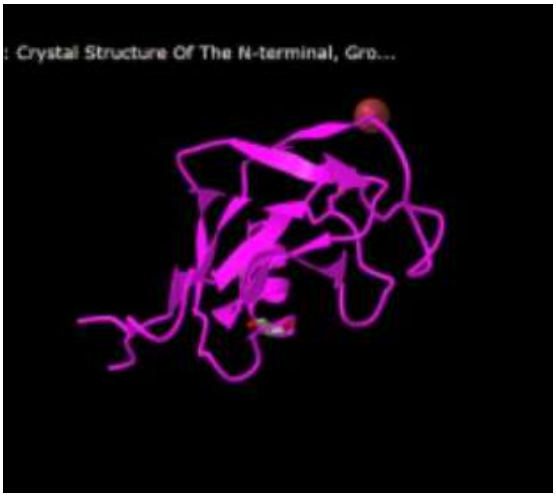
Research is being carried out in order to find additional evidence to firmly fill the evolutionary gaps, more research is still being carried out. It's debatable whether or not the organism was capable of high flight, and if so, what kind of flight it used. The majority of evidence is discovered in the form of fossils, yet preservation is an issue. The fossils have deteriorated over time as a result of their long existence, and little information can be recovered due to technological advancements.

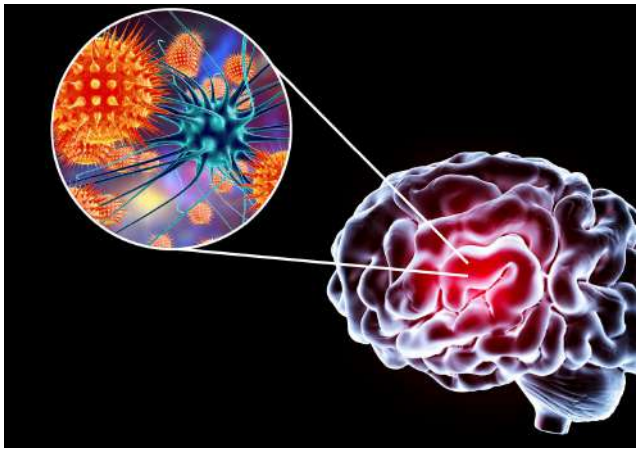
RIYA MEHTA

STUDY OF COGNITION DECLINE MUTATION IN HOMO SAPIENS

Are social factors completely responsible for degraded intelligence? The answer is no! Compared to our chimpanzee cousins, cognitive features of Homo sapiens are critically superior and advanced.

Cognition is a term referring to the mental processes involved in gaining knowledge and comprehension. However, a negative evolution pattern has been observed with respect to cognition. Cognitive decline may lead to trouble in learning, using language, or remembering things.There have been innumerous debates on whether or not a genetic factor is responsible for this. Humans with 'APOE e4' allele generally tend to have greater inclination towards rapid cognitive decline. This allele can considerably increase the danger of atherosclerosis, which also explains vascular reasons for cognitive impairment. In contrast to this the amyloid beta precursor protein (APP) gene is said to be a defence against cognitive decline, with a mutation present. This version is related to minimum amyloid deposition as amyloid is considered toxic for the brain and is ideal to defend against amyloid pathology.





From the data retrieved, the mutation shown by the gene showed forms of amyloid-β-containing neuritic plaques, the accumulation of which is a key hallmark in cognitive decline.
It is seen that the human being carrying the APOE e4-allele have possibly an accelerated cognitive decline, but this totally depends on the allelic pair one carries. It was observed with respect to the cognitive decline that the mutation in APP gene possibly reduces deposition of beta amyloid.

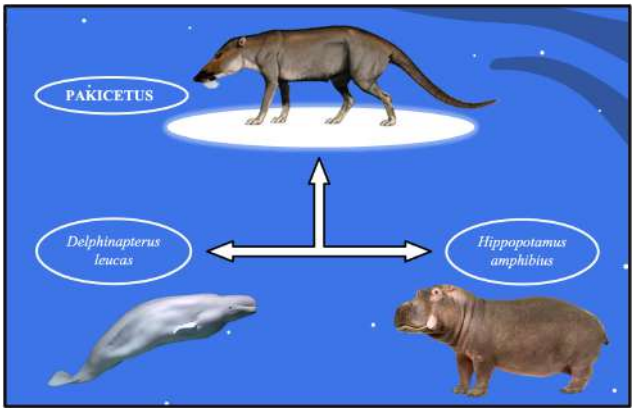
The conclusion we draw from this is that the mutation acts as a protection against cognitive decline holding an exception of Alzheimer's patients. The main concern of this is that a point mutation can convert a harmless protein into a toxic one, i.e if the substitution happens either way with different amino acids it might result in increasing toxicity rather than conferring protective function. Further work can be done in this area to minimise any possible errors with respect to this point substitution. But this mutation can be considered to be brought up for protection against surging cognitive decline cases.

SANIKA NAIK

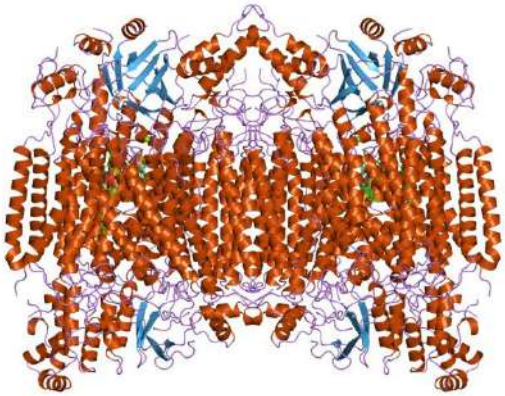
STUDYING THE EVOLUTION OF *Delphinapterus leucas* BY ANALYZING COX1 GENE

Did you know that whales could help in decreasing pollution? Well, they do. Whales play a vital role in the marine ecosystem where they help provide at least half of the oxygen you breathe and also combat climate change. The study aimed to determine whether *Delphinapterus leucas* (Beluga whale) and *Hippopotamus amphibius* (Hippopotamus) share a common ancestor using the evolutionary history of the COX1 gene. Gene evolution deals with changes at the gene level, usually the acquisition of new genes, the loss of old genes, changes in gene structure, and their impact on gene function and evolution.

We utilized the Cox1 gene which encodes for Cytochrome c oxidase which is the component of the respiratory chain that catalyzes the reduction of oxygen to water, as a base to study the evolutionary relationship between *Delphinapterus leucas* and *Hippopotamus amphibius* by taking support of NCBI GenBank and BLASTn which are bioinformatics tools. The BLASTn results included E-score, dot plot, and various data which determined that *Delphinapterus leucas* and *Hippopotamus amphibius* showed 80.25% homology. Assuming these species were a product of sympatric speciation. The speciation can be driven by evolution, which is a process that results in the accumulation of many small genetic changes called mutations in a population over a long period. Sympatric speciation is the evolution of a brand-new species from a surviving ancestral species even as each holds to inhabit the identical geographic region. So assuming that Pakicetus was geographically isolated which later evolved into different species i.e. *Delphinapterus leucas* and *Hippopotamus amphibius*.



The conclusion, from the NCBI BLASTn drawn is that *Delphinapterus leucas* and *Hippopotamus amphibius* though are different species now did have a common ancestor. The *Delphinapterus leucas* is an aquatic animal and *Hippopotamus amphibious* evolved into a semi-aquatic mammal indicating that genetic evolution did take place at some point. Studying the evolution COX1 gene helps to get a better understanding of *Delphinapterus leucas* and its ancestry relationship with *Hippopotamus amphibius*.



As evolution continues to function as an important foundation of biomedicine and life sciences, helping students learn and understand the scientific evidence, mechanisms, and impacts of evolution is a quality science. Knowing their past can only help us further understand and contextualize how whales make their existence today, and how we can better conserve them for the future.

ROSHANI GUPTA

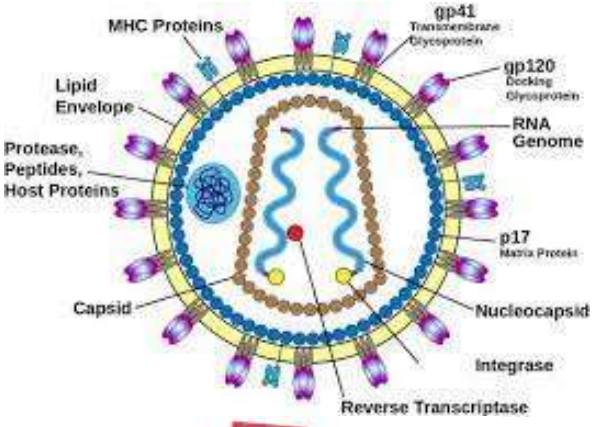
EVOLUTIONARY COMPARISON BETWEEN THE THREE SUBTYPES OF HIV-1 VIRUS

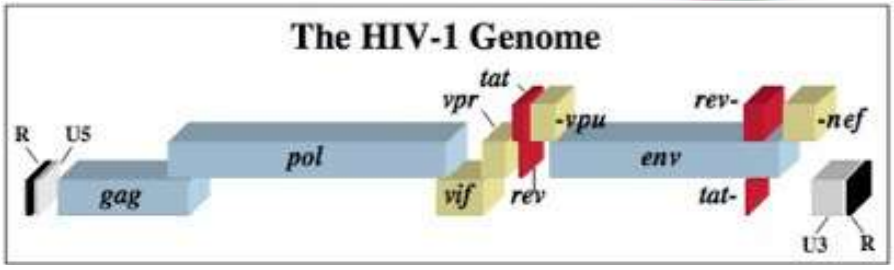
A virus is an infective agent of tiny size and easy composition which will multiply solely in living cells of animals, plants, or bacteria. Virus particles consist of genetic material housed within a protein shell, or capsid. The Human Immunodeficiency Virus (HIV) attacks the body's immune system. If left untreated, HIV can lead to AIDS (acquired immunodeficiency syndrome). Data from epidemiologic and phylogenetic analyses imply that HIV was introduced into the human population around 1920 to 1940. There is currently no effective cure for HIV, but the spread of the virus can be controlled with proper medical care.

The aim of this study was to facilitate a better understanding of the various subtypes of Human Immunodeficiency Virus and to understand the genes of the virus in a better way. This study will help in further research to understand the various mutations this virus undergoes to form its various subtypes and the spread of the virus worldwide.

The reason for selection of HIV-1 virus was to understand the low efficacy behind the production of vaccine for it. The 3 subtypes selected were B subtype, F subtype and BF1 circular recombinant form. 2 sets of genes were selected from the above-mentioned subtypes. The first set of genes contained 3 genes which were common throughout the subtypes. These included the Gag Gene, pol gene and Env gene. The second set of genes contained 3 uncommon genes between the three subtypes.

Bioinformatics tools were used to compare the results. The tools used were GenBank, BlastN, and ClustalW.





Comparison between the first set of genes led us to understand that those genes have no significant similarity between them. The reason for this is that they are associated with the same virus i.e. HIV-1 virus. When the second set of genes were compared, we found bands of dissimilar nucleotides and understood that the second set of genes differed from each other although being from the same virus.

The research done provides a molecular basis for HIV-1 evolution and subtype differentiation. This would extend our understanding of the evolution and differentiation of other RNA viruses, including emerging viruses. HIV/AIDS is the most lethal epidemic of our time. The evident gap concerning the character of immunity is needed for defence. Finally, the large value of basic analysis, manufacture and regulative processes is needed for immunization.

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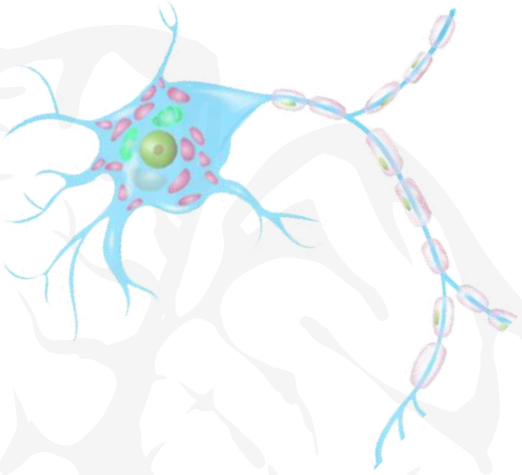
NACHIKET JOSHI

YOUR LEFT IS THE NEW RIGHT

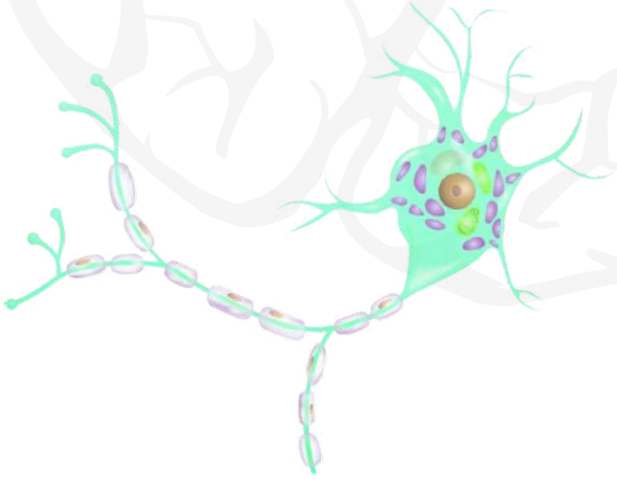


Most of the population performs tasks with their right hand but there are still 10% of them who use their left hand. It's a known fact that the left hand is controlled by the right hemisphere of the brain and vice versa. But scientists have discovered that the parts of the brain that control movements are different in left-handers and right-handers. This is because of brain lateralization which refers to the fact that the left and right sides of the brain are not the same in their anatomy and function. Left-handers have less lateralization in the brain as compared to right-handers. The best example to understand this is that language is the main function of the left side of the brain in right-handers. In left-handers, language areas are important but they often make use of both the hemispheres.

But what's the cause of handedness? Research shows that several genes contribute around 25% to handedness which suggests it's partly heritable. The other possible causes can be environmental factors or upbringing. Scientists reported in 2005 in the journal "Neuropsychologia" that fetuses will show a hand preference in the womb by sucking the thumb of one hand, a proclivity that continues after they're born.

The University of Oxford recently analyzed the DNA of about 400,000 people in the U.K. and found that four regions of the genome are generally associated with left-handedness. Three out of these four regions were also involved in brain development and structure. It's also proven that left-handed parents tend to have more left-handed children than right-handed parents do. Such type of handedness is not evident in other organisms, this calls us to shed light on this distinction which remains unclear to date.

- Manali Chakraborty




Do it Yourself

DNA EXTRACTION AT HOME

REQUIREMENTS:

- Onion 
- Salt 

- Hand Sanitizer 
- Vim liquid 

PROCEDURE:

Step I: Make "Magic Potion"

- 01 teaspoon of Vim liquid
- 01 teaspoon salt (NaCl)
- Add little water just enough to solubilize the salt.

Step II: Work the magic!

1) Chop 1/4th of an onion
2) Add the "Magic portion" to the onion and grind in a mixer/grinder
3) Filter using a muslin cloth
4) Put the filtrate into the refrigerator to CHILL.
5) Once the filtrate is chilled, add double the volume of CHILLED hand sanitizer. (At least 70% alcohol and is NOT GEL-BASED sanitizer)

SCIENCE BEHIND IT:

By adding salt, we help neutralize the DNA charge and make the molecule less hydrophilic, meaning it becomes less soluble in water. The salt also helps to remove proteins that are bound to the DNA and to keep the proteins dissolved in the water. The liquid dish washing soap here acts as a chelating agent. It chelates the metal ions present into the enzymes and as we all know that the metal ions are the cofactor which increases the activity of the enzyme. By chelating the metal ions, it deactivates the enzyme, therefore, reduces the activity of DNase and RNase. The higher the volume of alcohol and its temperature, it enhances the yield of DNA precipitation. To Elaborate this, alcohol has a lower dielectric constant than water, making it to promote ionic bond formations between the Na+ (from the salt) and the PO3- (from the DNA backbone), further, causing the DNA to precipitate. Also, The colder the ethanol is the greater the amount of DNA that is precipitated.

pH INDICATOR FROM RED CABBAGE

REQUIREMENTS:

- 1 head of red cabbage 
- Vessel 
- Sharp knife 
- Glass bowl 
- Spoon for stirring 
- Water 
- Blender 
- Strainer 
- Transparent cups 
- Household liquids for testing (vinegar, baking soda, soaps, etc) 

PROCEDURE:

- Take a red cabbage and cut off roughly 2-3 cups.
- Place the cabbage chunks in a pot of boiling water. Bring the water to a boil for a few minutes. Remove from heat and set aside for at least 10 minutes. (Alternatively, you can mix the cabbage with some water in a blender.)
- Strain and pour the water into a glass bowl and set it aside to cool
- Pour some liquid into clear cups or glasses after it has cooled and experiment with different liquids.
- Gently stir the solution with a spoon and see what happens!

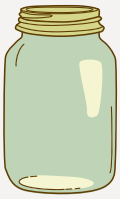
SCIENCE BEHIND IT:

Based on how much the color changes, you can know if something is acidic or basic. But why cabbage? So when red cabbage is exposed to an acid or a base, it releases anthocyanin, a color-changing water-soluble pigment. The pigment turns red in acidic surroundings with a pH less than 7 and bluish-green in alkaline (basic) conditions with a pH greater than 7.

MAKE YOUR OWN KOMBUCHA

Requirements

- Glass container
- 3 litres of water
- 1 cup sugar.
- 2-4 tablespoons loose tea leaves.
- 1 SCOBY
- Fresh herbs or spices (Optional).
- Cloth to cover the jar
- Rubber band


PROCEDURE:

Preparation of the SCOBY

1. Boil the water and allow it to cool for 2 minutes . Add the tea leaves to it and let it steep for 7-15 minutes. Filter and add sugar to it.
2. Pour this tea into a glass jar and place the SCOBY. Wrap a cloth around the jar and fasten it with a rubber band.
3. Keep the jar in a warm, dark place for 7-10 days, until the SCOBY takes up the shape of the jar.
4. Once the Kombucha has been brewed, add spices to your choice and enjoy the delectable kombucha.

SCIENCE BEHIND IT:

Kombucha is prepared from black tea, sugar, and a SCOBY (Symbiotic Culture of Acetic Acid, Bacteria and Yeast). Fermentation is the process involved where sugar is broken down in the absence of oxygen to create energy. Ethanol is produced throughout the process which is utilized by the yeasts and bacteria in the SCOBY to produce acetic acid. During fermentation, the SCOBY also interacts with polyphenols, which are micronutrients present in tea leaves and forms organic molecules. Compounds like these lowers the acidity and gives a peculiar taste to the kombucha.

COLOR YOUR FLOWERS

Did you know that flowers can drink up water and change their own colours into the colour of the water they drink?

REQUIREMENTS:

- White Flower

- Scissors

- Water

- Glass Jar

- Dyes (Food Colour)

PROCEDURE:

1. Trim down the stem of the flower.
2. Make a diagonal cut at the bottom of the stem so that it can easily absorb the water.
3. Pour water about half way in the jar or cup.
4. Add 5-10 drops of food color into the water and mix it well.
5. Place the flowers in the container and observe.
6. In 3-4 hours, the white flowers will start showing a tint of colour on them and after a few more hours, the color will properly be visible.

THE SCIENCE BEHIND IT:

The cut flowers take up water through their stem and the water moves from the stem to the flowers and leaves. Water travels up through xylem in plants by a process called capillary action. It is the ability of a liquid (in this case, colored water) to flow in narrow spaces (the flower stem) without the help of an outside force, like gravity. As water evaporates from a plant, it is able to pull up more water through the plant's stem. As it does so, it attracts more water to come alongside it. This is called transpiration and cohesion. Putting a colored dye in the water allows us to observe capillary action in plants.

GROW YOUR OWN HERBS

Having your own kitchen garden is a dream for many. A process that takes a lot of nurturing and patience. Plucking a few fresh leaves of basil or rosemary to garnish a freshly prepared warm meal sounds extremely satisfying.

Did you know you can grow your own herbs without even buying seeds?

REQUIREMENTS:

-Store-bought Herbs

- Pot/Milks Bags/Containers

- Soil with Compost

-Sharp Scissors

-Water

PROCEDURE:

1. Take a green stem of your herb and make a diagonal snip on it, just below a leaf node. (About 3-4 inches long).
2. Pluck the excess bottom leaves.
3. Place your cutting into a container of water under sunlight. Make sure to change the water every few days to promote growth.
4. After a few weeks you will notice roots emerging from the bottom of the cutting.
5. Post root development, transfer the cutting to a pot with fresh soil and compost.
6. Regularly water your herbs and watch them flourish!

THE SCIENCE BEHIND IT:

This is due to a method called vegetative propagation which is an asexual method of plant reproduction. It occurs in its leaves, roots and stems and can be used to grow herbs such as rosemary, basil, sage etc.

MAKING INVISIBLE INK AT HOME

REQUIREMENTS:

- half a lemon

- bowl

- cotton swabs

- white paper

- water

- heat source (candle/bulbs)

PROCEDURE:

1. Squeeze some lemon juice into a bowl. Add half a teaspoon of water to the bowl. Mix well.
2. Dip a cotton swab in the bowl. Use this swab to write a message on a white paper.
3. Let the paper dry completely after writing.
4. Bring the paper close to (not in direct contact with) a heat source like a candle or filament bulb. Heat the side of the paper that is not written on. (Note: Observe caution while working with the heat source.)
5. As the paper heats, the message begins to appear.

THE SCIENCE BEHIND IT:

Lemon juice is mainly made up of carbon containing compounds like sugars and acids. On heating the juice, these compounds break down and carbon is released from them. The released carbon reacts with air and undergoes oxidation. Oxidation causes the carbon to turn brown in colour. As a result of this, the message written using the lemon juice appears on the paper in a brown colour.


Mental Health

BACK WHEN I WAS BREATHING, NOT LIVING.

TAIBA KHAN

TW - DEPRESSION, SUICIDAL IDEATION

Dear diary,

I'm writing this today, with an immense sense of relief. I have finally completed 8 months in rehab and have been without any antidepressants for the past three months. I really feel as though I can finally see in colors, smell the flowers, and see the beauty in the things around me. It's like a huge load that has finally been lifted from my eyelashes. The unendurable numbness is no longer felt. Now even though I've come out the other side a much happier and healthier person, the journey was one I wouldn't wish on anyone.
The things that turned my life upside down, propelled my mental health downhill, and caused me depression, are all still in my memory fresh as new, but they no longer have the power and control over me as they once did four years ago.

My depression made me have agonizing feelings of hopelessness and worthlessness and excessive guilt almost every single day. 'Fatigue and zero energy for the things that once made me happy' became my new best friends. I couldn't make sense of my surroundings and had problems with concentration and decision-making. Days went by, and I would do absolutely nothing. It wasn't movement that I was missing, but the very desire to move. I felt so alone like I was both the sad person and the person trying to comfort the sad person.
It even got to the point where I would have recurring thoughts of death and suicide; all those hours writing in the notes on the phone about ways I could kill myself that would need the least amount of energy. Like I was only surviving, only breathing, and not living.

I carried it so well, people, from the outside, looking in, always assumed I was doing great in life and that I couldn't possibly have any problems. But once when my closest friend, Kiara, figured something was amiss and that I hadn't been my true self lately, she asked if everything was okay with me, even pushed a little, after which it all came pouring out. She was dumbstruck when she found out what I went through and how deeply it impacted my mental health and how low I've been in life. She worriedly suggested I go see a therapist and was kind enough to even send me contacts of a few. I was skeptical and doubtful about seeing a therapist and asserted that it wasn't so bad, because of the stigma around seeing therapists in our society.
But I finally gave in when she wouldn't give up on my health and me.

Living in an orthodox family, I couldn't leave the house without an escort so I booked a virtual appointment and after a few sessions, my therapist was able to help me document and come to terms with my experiences and the root causes of my depression and then prescribed antidepressants and anti-anxiety drugs. It took time, innumerable sessions, and a lot of patience, but thanks to all of Dr. Mathur's counseling and, sure, tons of medication, slow but steadily, I finally found peace and happiness in life. Some days were easier than others, some excruciatingly painful and sorrowful. But the line 'consistency is key', is absolutely true, I've learned.
The past will always be there with me, I won't be in denial, but I don't want to be the kind of person who obsesses over their pain. Thanks to all the help I was lucky enough to get, I'm learning how to change the narrative, redirect my energy more creatively and live the life I deserve.



MASTER OF DISGUISE

ANOUSHKA SETH

TW - EATING DISORDER, BODY SHAMING, BULLYING

“I was never a skinny child. In fact, when I was born, I weighed a whopping 9 pounds,” I began, earning a few chuckles at my humorous tone. “I was diagnosed with fetal macrosomia, a condition in which the fetus is born larger than normal, and that’s how it’s been all my life. I’ve always been considered ‘larger than normal’ but my mother likes to say it’s because I’m larger than life itself,” I remarked, earning a few smiles across the room.

“At the mere age of 8, I befriended a boy. He was my best friend, but his presence just seemed to make me aware of what I didn’t have — rather, of what I did have, which was a whole lot of fat plastered all over my body. As we grew older, he made other friends who seemed to enjoy poking fun at my weight. The group of boys never failed to remind me that I was overweight and alone. I tried to never let their words get to me, but there was only so much a 9-year-old-me could endure,” I said with a sad smile, remembering how much I despised myself as a child.

“The first week of 5th grade was supposed to be my fresh start. There I was, 10 years old and full of hope, ready to take on the world. The first step to do so was trying out for the football team, and so I did. Was I good enough to make the team? Maybe. Did I make the team? Not even remotely. ‘Each player must be at least 4’0 in height and weigh between 60 and 100 pounds,’ he concluded, making my heart shatter into pieces,” I explained, dryly chuckling at the overly-dramatic nature of a 10-year-old me.

“The doctors had declared me overweight, which turned out to be a long-term consequence of my fetal macrosomia. Nothing seemed to be going my way. My life seemed to have already been written out for me. Undeniably, my weight increased as I got older, and I began to lose hope. There I was, the largest 16-year-old-boy in my whole grade, making me stand out in the way that no one wanted to. I remember during Diwali, my mother ordered my favourite dessert – jalebi, and I wanted nothing more than to devour myself in them. When I reached for my 3rd jalebi, my aunt remarked, ‘Beta, don’t eat so much. You’ll put on more weight. Which girl will want to marry you then?’ My family erupted into a fit of laughter at her remark,” I said, cringing at that moment.

“Everything that I thought I’d moved past started to come back. All the bullying and self-hatred I’d endured began to play on my mind. My frustration & self-loathing nature began to manifest itself in the form of exercise. I’d make it a point to workout for at least 3 hours every day. My meals became minimal, lunch and dinner consisted of salads, each containing no more than 200 calories, and breakfast was out of the equation. I’d check my weight first thing in the morning, not knowing that it was slowly turning into an obsession. Watching the numbers drop on the scale gave me some kind of high. I lost 30 pounds within a month. People seemed to be noticing my transformation and I was no longer the odd one out. I became a master of disguise. With each compliment, I convinced myself to lose more & more weight, until I was consumed by it and associated my self-worth with my weight. My lack of eating and excessive exercising made me feel in control of how others perceived me. The feeling was addicting & empowering. I feared putting on any weight to the extent that I would have nightmares about it. ” I explained, taking myself back to how I felt at that moment.

“I began feeling faint, tired, and dizzy all the time. It started becoming harder and harder to breathe and my nightmares continued. Eventually, I collapsed, scaring both me and my parents, who immediately took me to a doctor. I underwent a physical exam, blood and urine tests, kidney function tests, an EKG (electrocardiogram) and a psychological evaluation. In due course, I was diagnosed with anorexia nervosa, which is characterised by an obsessive desire to lose weight,” I admitted, feeling a sense of relief take over me.

“I was then admitted to an anorexia rehab facility where I spent the next 30 days of my life. I was given small amounts of food, which was gradually increased until I could finish all 3 meals. I worked with psychiatrists and psychologists who helped me overcome my fear of gaining weight. I was taught that my body isn’t my enemy. I go to therapy once a week,

LET ME BREATHE

TW - PARANOIA, ANXIETY, PANIC ATTACK, DISASSOCIATION

This is a new chapter in my life. Away from home, with no one but my lonesome. I feel the crisp cool air but it brings nothing but melancholy.
The trees seem to shake, and the sun feels like fuel to the fire in my mind. The crowd around feels tighter like it's too much and as the leaves fall. I wish I, too could fall away in peace.
Light surrounded me, yet darkness seeped in. The cold embraced me, soaking me in its arms.
Million thoughts in my mind like a hurricane. It displaces my memories, and panic transudes in, Making my lungs tighter like I'm drowning in an ocean of my own insecurity.
The air seemed to leave me, scratching my lungs as it went. Alone I feel, and alone I am. Everyone's voices suddenly get louder, I feel like they're screaming, waiting to trigger my deep demise.
One blink and it's gone like it's all in my mind, but the anxious feeling of stares sends me into despair deep in my mind.

My leg bounces like it's sifting through the air, Hands shaking, but I'm going nowhere; lip trembles as a cry threatens to break; chest feels tight, like I'm confined to the demons in my mind.
My mouth starts to feel dry and all I want to do is cry.
Now, there's only one thing on my mind, "Will I ever be fine?"
I don't want to give in to demons, but that is exactly what I do: a dull pain in my heart and a shame I can't really explain.

I close my eyes and let the numbness seep in.
The world went dark and suddenly everyone disappeared, the only thing I could see was me failing. It feels like hours but it has only been a second I'm falling, deeper and deeper, a slow descent into ever-constant chaos, a plea, a cry, only the sounds of my failure reply, my hands stretched in front of me, one final call, from the darkness, a single piercing light, awakened a long-dormant hope.

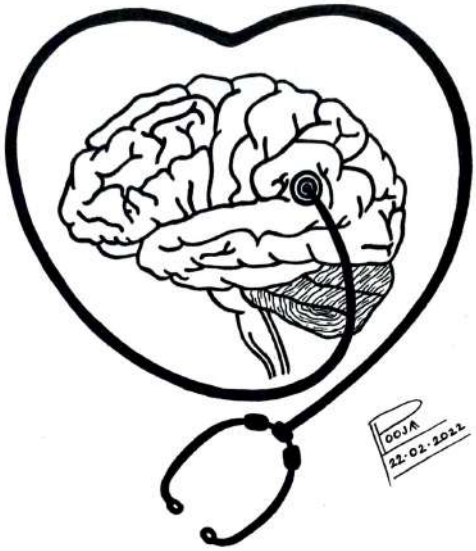
JHANVI CHANDALIA

I open my eyes and see you there, I can't feel you, but you are here.
Holding onto me until I'm back, back from the depths of hell.
I need you to convince my body, that it is okay.
I don't want to move, for if I move, I might fall again.
I'm walking on a rope of worry, and I hope that I don't fall again.
I rise up again, and saw people, giving me the 'stare.'
How would they know? This, for me, has become, just a Monday routine.

I don't know when things will get better, but I do know I'll have to work for it. If it's so important, why is it looked down upon?
Why do they scoff at seeking help and therapy? I think this might help. I think this will help me breathe.
I am fighting now, a new way of trying to understand, it won't pick me up but it will give me its hand.


Teacher's Talk

ILLUSTRATIONS



- MS POOJA GUPTA

- MS NILOUFER KOTWAL

Roses are Red.
Violets are actually Violet not Blue!
We're not too good at making rhymes.
So here's our favourite Genetic Ode for you!

A genetic ode, or A melan coli tale

I used to be a coli, as wild as wild could be.
They called me Proto Trophic, whatever that would be.
They kept me pure and simple and completely free from faults
And fed me on the simplest food... glucose and common salts.
Then Lederberg and Tatum came and put me in the sun
And watched me very closely to see what harm they'd done.
Although they hadn't killed me they had really hurt my pride
And though I looked quite normal I was quite upset inside.
Next day they tried to feed me with my normal sort of food
But they found I couldn't use it in the way I always could.
Glucose I could metabolise-in that I was proficient,
But in synthesising valine they soon found I was deficient.
They couldn't find their valine so they went to biotin
And till they thought just what to do they kept me dietin'.
Then foresight and discernment made this lecturer and Prof.
Enrich my food with Oxo cube and call me Oxo Troph.
They called another doctor and they all discussed my case,
And decided that my DNA must have displaced a base.
They all seemed quite excited and I heard Doc Tatum say,
"Another dose of sunshine might upset more DNA."

They gave me 80 seconds of the brightest light I'd seen,
And I knew a UV photon had displaced another gene.
I remember seeing Lederberg- eyes gleaming through his specs
Excitedly tell Tatum that I'd now acquired a sex.
Then Lederberg asked Tatum if he could foretell my fate
And Tatum thought my only hope was to acquire a mate.
So they gave me you dear Effplus, knowing you alone could right
The little bits of DNA that suffered in that light.
There's just two things I ask you if you really care for me
One little gene for valine- one for fertility.
Your genotype's just perfect to revitalize my strain
And I know you will co-operate to make me wild again.
Be warned O Human Beings by this melan coli ode
You who think you are so clever cracking our genetic code.
There's a moral in this story-I will tell you what it means:
IF YOU STRIP TOO MUCH TO SUNBATHE,
YOU MAY LOSE A PAIR OF JEANS.

- Donald Nicholson

Epitome of Eminence

In a world where most of us wander - lost, confused and hypertense,
Some teachers help us in the quest of the meaning & purpose of existence;

In a world where students are prepared for something,
Some teachers help students prepare themselves for anything;

In a world where the directive is to aim high,
Some teachers enlighten young individuals to reach the sky;

In a world where the term 'good teacher' is a misnomer,
Some teachers play an invaluable role in the social stormer;

In a world where life lessons are taught bare minimum,
Some teachers teach students, and not the curriculum;

In a world where everyone's busy in their own world,
Some teachers ensure that their students are impearled;

In a world where stress forbids people to hold up,
Some teachers are the reason why students 'don't give up';

In a world where teachers are viewed as 'just teachers',
Some teachers turn out to be an 'Epitome of Eminence'

- Ms. Pooja Gupta

Hotspots of Jai Hind

'Retrospect' makes everything sound good. May that be the days of our childhood where we hated to go to school (but cried when we left school), or the homemade food which our mum would force down our gullet (but now have Lays for lunch). In 'retrospect' those were the best days of our lives.

I, for example, have had the opportunity to comprehend the term ‘retrospect’ in a very holistic manner. I had been introduced to Jai Hind College in bits and pieces at a stage where I could not pronounce ‘Jai Hind College’. My official entry to JHC was as an awkward 16-year-old. Time passed, (but the awkwardness didn’t) and I was soon to enter my Bachelor’s program. I was nervously optimistic about it because I felt I had not only entered a phase that involved science beyond the usual medicine-engineering vision, but also because it gave me an opportunity to follow and blossom in activities which I was really passionate about.

During the days of our initial struggle or during the twilight of our course, this one particular "hotspot" has seen us grow from 11th standard ‘kids’ to ‘slightly mature TY kids’. We could easily call it our Eid ka Chand bunking spot (reason: science student), our spot where we frantically had our last-minute revision before exams, the spot where we would vent all our frustration if our rehearsals wouldn’t go as planned, and also the spot where that sneaky black cat ate my lunch!

Now being on the other side of the fence, it gives this scene a totally different meaning, because this is literally the time the retrospect sets in. Having the responsibility of the profession and the expectation of the esteemed alma mater, it encompasses all those memories but in a completely different way (my awkwardness still persists though).

Today as I pass by this unoccupied hotspot (reason: Pandemic!) which would usually be hustling with girls and boys gossiping or having last minute revisions, I don't feel nostalgic.

I feel hollow, because these huge slabs of marble carved into steps in a grey and white pattern, with the occasional spattering of dry leaves, has seen us grow from individuals eager to explore the world to individuals wanting to revisit those few moments again. Those steps have seen hundreds of girls and boys blossoming into adults, only to come back and realize how inanimate objects have a small but lasting impact on us.

Nobody knows what is in store for them in the future. Nobody knows if the path we are following now is something we will continue to till the rest of our lives. Nobody knows if all 18 of my batchmates will ever get a chance to sit at those steps again. Nobody knows anything. But, what we do tend to figure out sooner or later, is that these small examples are so instrumental in shaping our journey. Little did I know, that I would treasure this spot only after I had my backside kicked into the real world! However, I really hope that that particular “hotspot” has a special place in everyone's heart, and it always pulls a few strings whenever we revisit it. :)

- Ms. Zeenia Avari

It's A Wrap

CLASS OF 2022

Riddhesh Ahire

Shruti Anand

Anamta Ansari

Mariam Dadani

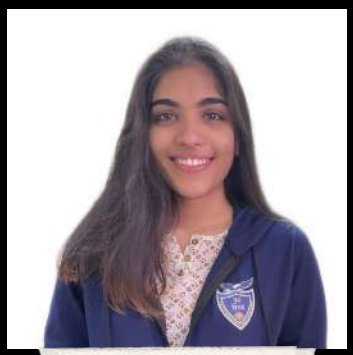
Avani Dave

Roshni Keshwani

Zarhaan Khambatta

Izza Mapari

Richa Mishra



Anushka Pai

Avani Patil

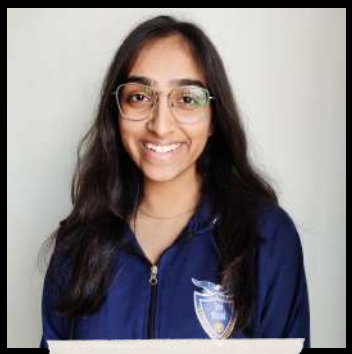
Dania Patni

Jheel Popat

Odelia Rebello

Mahek Sangoi

Jafrin Sayad



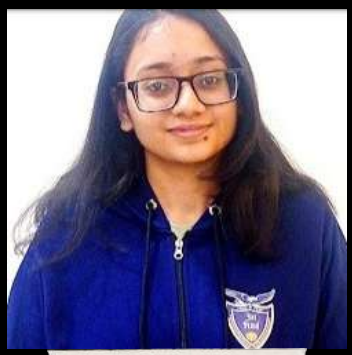
Irshikaa Sharma

Akanksha Singh

Stuti Srivastava

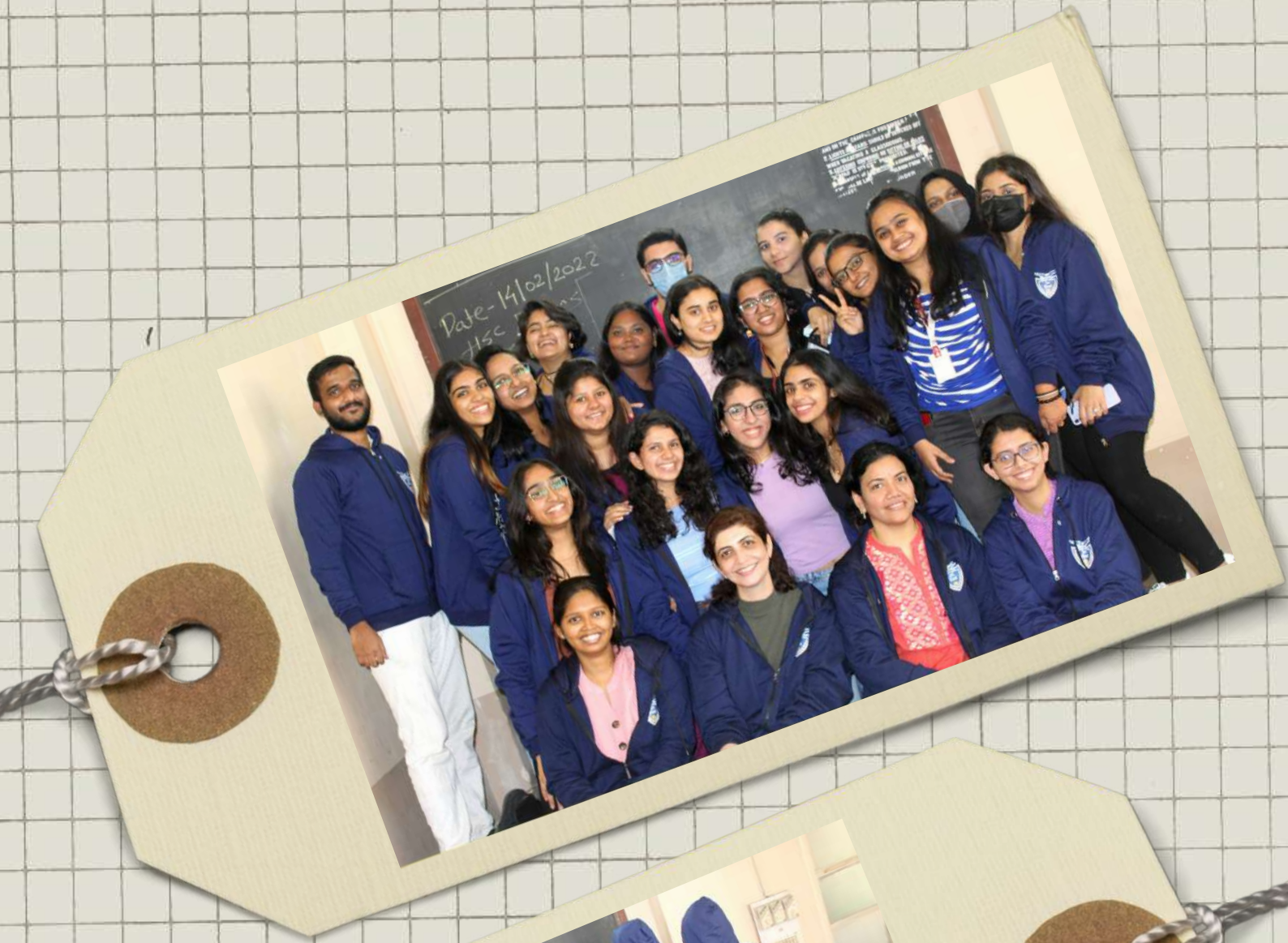
Iqra Teli

Yogita Tiwari



Mittali Sharma

Pranali Mani


Date-14/02/2022


ANJMTA
JHEEL
PRANALI
RICHA
AD
IRSH
3.14
AAJ
ODELIA
PEACE
DAP
STYLE
RMK
AP
ANAND
RIDD
ZARHAAN
SLEEPY NERD

#learnfromhome

#unmute

of the island being brought back to life

#covidbatch

life

#2019-2022

#googlemeet

DEPARTMENT OF LIFE SCIENCES